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## Contents.

**Congress at Folkestone.**

SECTION A.—Sanitary Science and Preventive Medicine.

"The Prevention of Smoke Pollution," by Professor Leonard Hill, M.B., F.R.S. ... 41

"Smoke Abatement," by J. S. Owens, M.D., A.M.Inst.C.E., F.G.S. ... ... ... 44

"Pasteurised versus Clean Milk," by C. W. Hutt, M.A., M.D. ... ... ... ... 52

"Pasteurised versus Clean Milk," by Wilfred Buckley ... ... ... ... ... 57

"The Position of Hospitals in relation to the New Ideals of Preventive Medicine," by W. J. Tyson, M.D., F.R.C.P., F.R.C.S. ... ... ... ... ... ... ... 59

"The Hospital and the Primary Health Centre in relation to a Health Service from the standpoint of the General Practitioner," by E. L. Martyn Lobb, M.S., F.R.C.S. 63

"Gloucestershire Scheme for the Extension of Medical Services," by J. Middleton Martin, B.A., M.D., D.P.H. ... ... ... ... ... ... ... ... ... 70

SECTION B.—Engineering and Architecture.

"Designing a New Township for 120,000 Inhabitants," by G. Topham Forrest, F.R.I.B.A., F.R.S.E., F.G.S. ... ... ... ... ... ... ... ... 77

"Communal Heating and Hot Water Supply," by John A. Macintyre, B.Sc., M.Inst.C.E. 88

"The Utilisation of Sewage Sludge," by John D. Watson, M.Inst.C.E. ... ... ... 90

"The Design of Hospitals," by Edwin T. Hall, F.R.I.B.A. ... ... ... ... 97

"Rural Housing," Miss C. Cochrane ... ... ... ... ... ... ... ... 103

"Cairo: A Brief Survey of its Drainage and Sanitary and Public Health Administration," by Arthur H. Davis, F.S.I., F.A.I. ... ... ... ... ... ... ... ... 107

"The Folkestone Waterworks Undertaking, 1848-1921," by Henry T. Turner... ... 113

**Lecture to Institute.**

"Some Lessons of the War," by Col. C. H. Melville, C.M.G., M.B. ... ... ... 117

**Supplement—**

Reviews of Books ... ... ... ... ... ... ... ... ... ... *21*

Meetings held ... ... ... ... ... ... ... ... ... ... ... *23*

Forthcoming Meetings... ... ... ... ... ... ... ... ... ... *25*

Dominion and Foreign Notes ... ... ... ... ... ... ... ... ... *26*

Calendar ... ... ... ... ... ... ... ... ... ... ... *27*

Elections ... ... ... ... ... ... ... ... ... ... ... *30*

## LIST OF ADVERTISERS.

The numeral indicates the page on which the Advertisement appears; the dash (——) denotes that Advertisement is not in this issue.

Activated Sludge Ltd. ... ... xvi
Balliere, Tindall & Cox ... xiii
British Commercial Gas Assn. ... xv
Building Products Limited ... —
Burn Bros. ... ... ... vii
Cadbury Bros., Ltd. ... ... vi
Candy Filter Co., Ltd ... ... —
Churchill, J. & A. ... ... —
Clark, S., & Co. ... ... —
Claughton Bros., Ltd. ... ... xii
Constable & Co., Ltd. ... ... xiv
Crapper, Thomas, & Co. ... xi
Doulton & Co., Ltd. ... ... v
Educational Supply Assn., Ltd. xvii
Glaxo ... ... ... ... iv
Grampian Engineering Co., Ltd. —
Harrison, G. W. & Co.... ... xi
Hoover Suction Sweeper Co., Ltd. —
Horlick's Malted Milk ... iii
Jackson, Elphick & Co., Ltd. ... —
Jennings, George, Ltd. ... ix
Kerner-Greenwood & Co. ... vi
Lewis, H. K., & Co., Ltd. ... xiv
London Hygienic Chem. Co., Ltd —
London Warming Co., Ltd. ... —
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Manlove, Alliott & Co. ... x
Newton, Chambers & Co., Ltd. iii
O. Bruster & De Launoit ... iii
Pontifex, H. & Sons, Ltd. ... viii
"Ronuk," Ltd. ... ... ... iv
Royal Society for the Prevention of Cruelty to Animals ... —
Sankey, J. H., & Son, Ltd. ... vii
Sapon Soaps, Ltd. ... ... —
Septic Tank Co., Ltd.... ... ix
Silicate Paint Co. ... ... vi
Stimex Gas Stove Co. ... —
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Webb Lamp Co., Ltd. ... —

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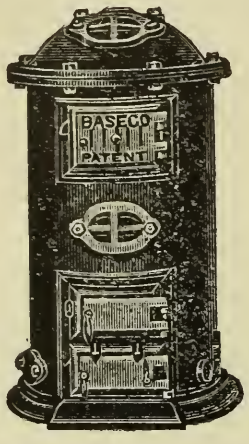


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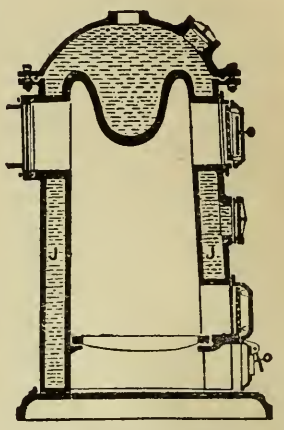

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# JOURNAL

OF

# THE ROYAL SANITARY INSTITUTE

## CONGRESS AT FOLKESTONE.

### SECTION A.—SANITARY SCIENCE AND PREVENTIVE MEDICINE.

#### The Prevention of Smoke Pollution.

By Professor LEONARD HILL, M.B., F.R.S.

THE securing of a national economic use of coal and the prevention of smoke are one and the same problem. The waste of coal fouls the earth with ashes and soot, the sky with smoke, destroys beauty, dirties houses, makes cities dismal, causes vast expenditure in cleaning, painting, rehanging and furnishing. Fog caused by smoke wastes artificial light, and, by impeding transport of people and goods, interferes greatly with the conduct of business and manufacture. The material damage done by smoke to property in Manchester and Salford has been estimated at one million pounds a year, or about one pound per head of population. In Pittsburg, the damage was estimated at four pounds per head. The loss of health and happiness is immeasurable. Men live long who work in the clean moving air and sunshine of the fields. While the expectation of life for females at birth (1911-12) in Westmoreland was 66·6, and in the rural districts of Norfolk and Suffolk 61·03, it was in the county boroughs of the north 49·93, in Middlesborough 46·65. No less imperative than a clean water supply or proper drainage system is the supply of fresh air and sunshine. Through stopping the evaporation of water, and the warming of the ground, by cutting off the radiant energy of the sun, smoke greatly increases the cold and dampness of the English climate, and impels people indoors and to indoor occupations and pleasures in place of taking healthy exercise out of doors. The deleterious effects so produced are vastly more important than the blackening of the lungs by inhaled soot. Coal miners, whose spit is black with coal dust, are exceptionally healthy, and so free from consumption that it is thought that coal dust may even be antagonistic to infection by the tubercle bacillus. It seems to stimulate the lining cells which keep the lungs clean. Flue dust, however, has not this beneficial action.

The immense importance of sunlight and cool fresh moving air bathing the body is shewn by the wonderful cures effected on cases of tubercular, spinal and joint disease at the Alpine sanatoria. The children play and work there naked except for a loin cloth, brown as niggers. Not only in summer but in the snows of winter. The visible (luminous) rays of sunlight are of immense importance because they penetrate the skin and locally warm up the blood which absorbs them in the subcutaneous vessels, while the body as a whole is kept cool by the cool moving air.

On the other hand the dark heat rays are absorbed by the surface of the skin, and make this warm.

The ultra-violet rays have also no power to penetrate. They are absorbed by as little as one-tenth of a millimetre of the outer horny layer of the skin. It is not then the ultra violet rays but the luminous rays which have so powerful an effect on health, and pigment is produced in the epidermis to absorb and ward off the over effect of these rays on the blood circulating in the dermis.

It has recently been shown by Sonne in the Finsen Light Institute that the skin can stand, without being scorched, twice as much radiant energy in the form of visible sun-rays as it can of dark heat-rays, because the visible rays largely penetrate, and, warming the blood locally, are carried away as heat to cooler parts of the body; the dark heat rays absorbed by the surface of the skin make us feel warm and stuffy indoors; while the blood is warmed by the sun and the surface of the skin is fanned by the breeze out of doors.

We know that the visible rays, combined with exposure to open air, acting on the blood and cutaneous tissue increase the immunising power against disease. It is madness, then, to cut off the sun by smoke and warm ourselves in houses by dark heat waves from hot water, or steam coils, and shut-up stoves.

The cool moving air outdoors stimulates metabolism, and makes us breathe deeper, increasing oxidation processes, using up the food, and stimulating appetite. It impels us to take exercise to keep warm. Exercise in its turn makes far more active the circulation and breathing; the belly organs are massaged through muscular movements and the taking of deep breaths, and these, with the increased circulation and oxidation, prevent constipation and the poisoning of the body by those products of bacterial decomposition which arise in the bowels of sedentary indoor workers.

Sunlight warming the blood locally, cold moving air keeping the body cool and stimulating metabolism, open air exercise, these are the great factors for health next to good food and sufficient sleep, and of these the people of the cities are largely deprived. The sun energy which reaches

the sea level is half that at 1,800 metres high in the Alps. Smoke robs us of much of that which does penetrate through mist and cloud. Thus in Manchester and Glasgow, 1901-10, the percentage of sunlight in the winter was 40-50 less than that in Stonyhurst. In Leeds, it has been estimated, that the hours of bright sunshine are 17 per cent. fewer, and the intensity of diffuse daylight 40 per cent. less than in the outskirts of that city.

The choking of the stomata of leaves by tarry matter, and the presence of free acids in the air, and deposited on the soil of our cities, have a most detrimental effect on vegetation, and lessen the pleasure and health derived from the cultivation of gardens and allotments, and the enjoyment and use of public parks. The destruction of vegetation is of the greatest importance to health, not only from the æsthetic side, but from the fact that fresh green foods and milk of cows fed on such are protective foods, containing the essential vitamines. The want of these subtle principles, necessary for growth and nutrition, is one of the great causes of malnutrition in cities. Thus rickets is caused both by want of vitamines and the confinement of children in tenement dwellings.

Garden cities free from smoke are required, in which the leisure of the factory hands can be devoted to the rearing of green vegetables, rabbits, fowls, and milk-yielding goats, to the improvement of their dwellings, and the playing of open-air games. The provision of such is the one method of preventive medicine which is of supreme importance.

So inefficient are the present means of converting the thermal energy of coal into power, steam or electric, or into light, that according to the high authority of Prof. W. A. Bone, no less than 95 per cent. of this energy is wasted, and at the same time 50 millions' worth of damage done by the waste products. The average efficiency of electric stations in producing power from coal is given as 8 per cent. Only $\frac{1}{2}$ per cent. of the fuel value of the coal used to produce it is converted into electric light. In contrast to such inefficiency, the luminous efficiency of the glow-worm or fire-fly is 100 per cent ! By carbonising all coal at gas works, and using the coke for generating electric power and lighting, gas for heating, lighting and power, and securing the valuable by-products, an enormous saving of coal can be effected, and the nation's coal supply made five times greater without an extra ton being dug. At the same time, the sky and the cities can be made clean, and health, happiness and human efficiency vastly increased.

By low temperature carbonisation of certain coals, a smokeless semi-coal can be obtained for fuel and a light oil which can replace petrol. The great need of the moment is to cheapen the production of gas and smokeless fuel.

We want to warm ourselves in this damp climate by radiant energy in luminous form. The coal fire is the cheapest source of such energy, but the time spent in tending to it and its dirt and the loss of health, etc., due to smoke pollution makes it, in truth, the dearest.

According to Prof. Bone, 89 per cent. of the energy of a ton of coal is secured after carbonisation at the gas works, in the gas 23 per cent., in the coke 60 per cent., in the tar, etc., 6 per cent. The modern radiant-heat gas fire gives us some 15 per cent. of the thermal energy of the coal used for producing the gas, and the efficiency of gas water-boilers is almost as high. From the coke, electric or steam power may be secured, giving 8-13 per cent. of the thermal energy of the coal, and then the tar products and the valuable manure, ammonium sulphate, are secured in addition, and the sky is not darkened, or our houses, clothes, and bodies polluted with smoke and ash. To use electricity generated from coal for heating is, as the late Lord Moulton said, "a ghastly waste," for from the present electric stations, only 8 per cent. of the thermal energy of the coal is secured, against some 25 per cent. secured by carbonisation at the gas works and the use of gas, coke and by products. By turning coke into electric power and supplying this power and gas for heating to every house, home industries can be revivied, and life made immensely happier in garden cities than it is at present spent in factories and one, two, or three-room tenement dwellings.

The coal crisis will be a blessing in disguise if it forces the nation to use gas, coke and smokeless fuel in place of raw coal, and thus clean the sky and conserve the national coal stores for foreign barter and future use.

---

## Smoke Abatement.

By J. S. Owens, M.D., A.M.Inst.C.E., F.G.S., Superintendent Advisory Committee on Atmospheric Pollution (Fellow).

I PROPOSE to deal very shortly with the cause and prevention of smoke as this aspect of the matter has been thoroughly dealt with many times recently, and this Congress is not so much an engineering as a sanitary one. I will, therefore, refer very briefly to a few of the main facts which are now beyond dispute.

*Cause of Smoke.*—The smoke from burning coal is always due to imperfect combustion but the loss of fuel represented in solid smoke is small, varying from, perhaps, a maximum of $\frac{1}{4}$ per cent. of the fuel burnt in boiler furnaces to 5 per cent. in open domestic fires. Smoke can only be formed from fuel containing volatile matter, hence the smokiness of a particular coal is to some extent a function of the amount of volatile matter contained.

The two main sources of smoke are industrial furnaces and domestic fires. In the case of the former, smoke in any quantity results from either badly designed or over-worked furnaces, or bad stoking. The main point to bring out at present is that smoke from this source is practically entirely preventable without hardship. There may be one or two exceptions, such as furnaces for certain processes in the manufacture of steel, and pottery kilns.

Smoke produced from domestic fires is on quite a different footing, it is not possible, by any known means, to prevent smoke from an open grate burning bituminous or smoky coal ; the only remedy here is the burning of a smokeless fuel, which may be either gaseous or solid. I am aware that many claims are made for different grates but do not think I am overstating the case when I make the above assertion. The salient point to note here is that the prevention of smoke can only be attained by the use of smokeless fuel. Much has been said as to the relative merits of gas, coke and anthracite ; each has its particular advantages, and to some extent its own sphere of usefulness, but into this question I do not propose to enter. I would say, however, that of domestic fires the kitchen range is probably the worst offender, and would go so far as to suggest that the use of a kitchen range burning smoky coal should be prohibited.

*Effect on the Atmosphere.*—The chief aspect of interest to this Congress will doubtless be the effect of smoke upon the atmosphere, and for many years this has been a subject of much controversy, arising mainly from the fact that no accurate data were available to enable us to compare the state of the atmosphere at one place or time with another. That state of affairs has now been changed and accurate data are available, owing to the work of the Advisory Committee on Atmospheric Pollution. It is no longer possible for the producer of smoke to deny its effect upon the purity of the air, so that his attention is drawn towards attempts at proving the data are unsound or, alternatively, that the pouring out of impurities into the air is an essential to his work. Difficulties of the same kind arose when regulations were brought into force for preventing the pollution of drinking water.

Roughly speaking, a man consumes 30 to 50 lbs. of air per day, 2 to 3 lbs. of food, and 4 to 5 lbs. of water ; that is, over four times as much air as food and water combined, yet the necessity for keeping the air pure is not yet fully realised, although much has been done of recent years to open the eyes of the public.

The two chief measurements aimed at by this Committee have been :—

(*a*) Deposit from the air.

(*b*) Suspended Impurities.

*Deposited Matter.*—Dealing first with deposited matter: Although it is not a measure of total impurity it may be assumed to vary with this. It is easily measured, as all that is needed is an open topped gauge vessel with provision for catching everything which falls into it; the dust in fine weather and the rain in wet. The whole is removed monthly, weighed and analysed.

We have about 30 stations measuring deposit, but nearly all in cities.

To show the variation in the quantity of impurity deposited at different places, even when comparatively close together, I give the following table in which, opposite each station, is given the mean monthly deposit of solid impurity for the year ending March 31st, 1920:—

| | Tons per sq. mile. | | Tons per sq. mile. |
|---|---|---|---|
| Southwark Park, London | 39·30 | Ruchill Park, Glasgow ... | 24·40 |
| Ravenscourt Park, London | 36·07 | Alexandra Park, Glasgow | 24·29 |
| St. Helens ... ... | 35·40 | Bellshouston Park, Glasgow | 22·71 |
| Richmond Park, Glasgow | 31·10 | Meteorological Office, South Kensington ... ... | 21·58 |
| Tollcross Park, Glasgow | 29·92 | Queen's Park, Glasgow ... | 20·51 |
| Blythswood Square, Glasgow ... ... ... | 29·26 | Victoria Park, London ... | 19·20 |
| Golden Lane, London ... | 28·88 | Southport, Hesketh Park | 16·41 |
| Botanic Gardens, Glasgow | 27·93 | Southport, Woodvale Moss | 13·67 |
| Finsbury Park, London... | 27·60 | Rothamsted ... ... | 10·52 |
| Victoria Park, Glasgow... | 26·57 | Malvern ... ... ... | 7·02 |

It is not easy to realise exactly what these figures mean, but if we take the average deposit over London for the year ending March 31st, 1920, it amounts to about 40,000 tons. This is better than it has been, as in 1916 it came to about 55,000 tons, since when it has steadily diminished.

The following curve (Fig. 1) shows the deposit over London from 1915 to 1920.

This deposit in London when analysed is found to consist approximately of :—

| | Per cent. |
|---|---|
| Tarry Matter... ... ... ... ... ... ... | 0·70 |
| Carbonaceous or sooty matter ... ... ... ... | 15·60 |
| Mineral matter insoluble in water, ash, etc. ... ... | 36·20 |
| Soluble matter, combustible or volatile ... ... ... | 13·40 |
| Soluble matter, mineral ... ... ... ... ... | 34·10 |
| Total ... ... ... | 100·00 |

*Suspended Matter.*—A method of measuring suspended impurity in cities has been devised and has now been in continuous operation in London for some months. Briefly, the method consists in the use of an automatic

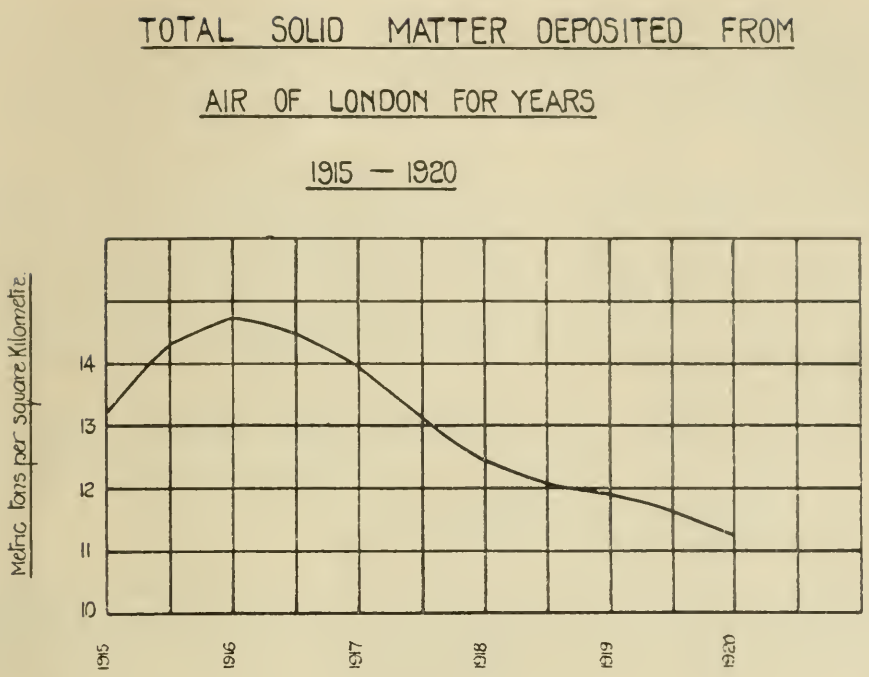



Fig. 1.

instrument (Fourth Report of the Committee for the Investigation of Atmospheric Pollution), which filters a fixed volume of air through a small disc of white filter paper at short intervals. The impurities are left behind on the paper, and, by the aid of a carefully calibrated scale of shades, provide a measure of the quantity of impurity in known units.

It will be realised that if matter is very finely divided and thrown into suspension in the air it may have little tendency to settle. When the diameter of the particles falls to, say, 1/20,000th of an inch, the very slightest disturbance of the air keeps them from settling. I have ascertained by measurement that a large proportion of the suspended matter of the air is below this size and varies between 1/100,000 and 1/20,000th of an inch in diameter It, therefore, behaves almost like a gas and penetrates everywhere. Previous to measuring the diameter I had noticed that during a London fog or even an ordinary winter's day in London the record of impurity obtained on the standard instrument was the same, whether taken in a room with closed windows or outside, the fine suspended impurity penetrated into the room unless it was absolutely air tight

It is a common experience in London to find articles shut in drawers or cupboards covered with a layer of black deposit, even after a short time. This fine suspended dirt is in some respects more interesting than that which is deposited quickly. We breathe it into our lungs and retain some of it there, although fortunately, about 70 per cent. of it passes out again in the expired air.

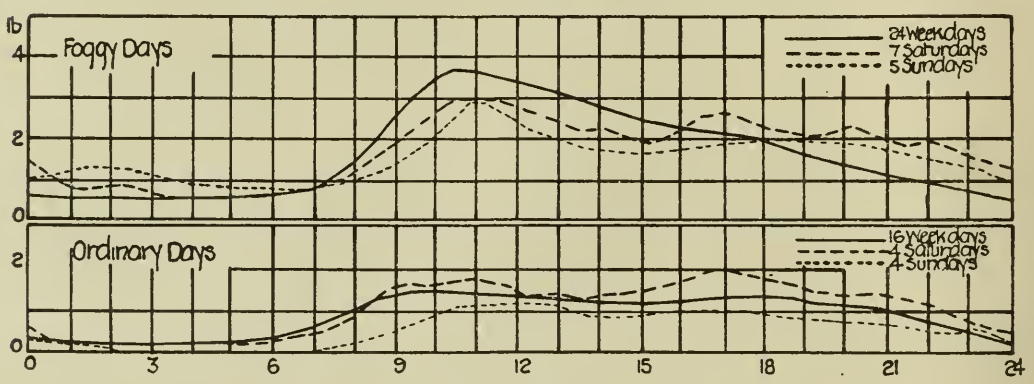
This passing out of dirt in expired air is a fact I commend to your attention. It is usually assumed that the nose and air passages completely cleanse the air of dirt, but this is not the case as I have found experimentally.

Systematic measurements of suspended impurity are now being made at the Meteorological Office, at Kew Observatory and at my office at 47, Victoria Street, Westminster, giving the state of the air at intervals of about fifteen minutes, night and day. From these records curves of impurity have been prepared and much useful information is being derived from a study of these curves.

Several such curves are now before you. Fig. 2. These show :—

* (*a*) Foggy days, divided into week-days (excluding Saturdays). Saturdays and Sundays.

(*b*) Ordinary days—similarly divided.




Suspended Impurity in London Air

Variation at Westminster in the number of pounds of dirt in a 100 yard cube on selected days in the winter 1920-21.

Fig. 2.

Much has been said and many opinions given as to the relative importance of domestic and factory fires in contributing to atmospheric pollution. To show the importance of measurements such as we are making in solving such problems we will refer to the curves :—

It will be seen that certain features are common to all, namely a pure air between midnight and 6 a.m. while people are in bed, a rapid increase of impurity from 6 a.m. to about 10 a.m. when they are busy lighting and making up their fires, and a rapid fall in the impurity between 10 p.m. and 12 p.m. when they go to bed again. It is noteworthy that this rapid fall does not correspond with the hour of closing factories, say about 6 p.m., but that of letting out domestic fires.

* See Met. Mag. March 1921.

Again, there is a noticeable peak about tea-time on nearly all the curves.

If we compare normal week-days with Saturdays and Sundays there is little difference in the amount of impurity although factories are closed most of the day on Saturday and all day on Sunday.

There is no remarkable falling off on Saturdays after 1 p.m., although most of the factories are shut about that hour.

On non-foggy Sundays there is a distinct delay in the maximum when compared with week-days, obviously owing to a later breakfast hour.

All these point towards the domestic fire as the chief source of atmospheric impurities. We have, therefore, a group of facts emerging from these curves each of which points in the same direction, and the cumulative evidence of which it is impossible to ignore.

Again, do these curves give any indication of a remedy apart from the general one that the domestic fire is the chief sinner? There is a very curious peak to be seen on all the curves about 10 a.m. Why should such a peak occur? One might reasonably ask, are not the domestic fires burning all the afternoon and why then does not the impurity increase steadily all day?

When smoke is being poured out of London chimneys it very rarely, if ever, happens that it all can collect in the air over the city, there is usually a wind which carries some of it away. Under certain conditions, however, a large proportion may collect, or in other words smoke may be produced more rapidly than it is swept away by the wind.

Consider a normal London day when there is no absolute stagnation of the air, but a slow drift over the city into which drift thousands of chimneys are pouring their smoke, and at one point samples are being taken to measure the quantity of impurity. As long as the conditions remain steady, *i.e.*, the rate of removal of smoke does not alter, the amount of impurity recorded will be a measure of the amount of smoke produced at that time, or rather a little before.

Should the rate of removal increase or diminish we would get a corresponding increase or reduction in the amount recorded.

We may take it then that unless the air is completely stagnant and the conditions prevent the removal of any smoke the records of impurity may be taken as records of rate of smoke production. This is very important, as if we look at the curves from this new point of view a remarkable new piece of information comes to light. That is, the time of the day at which the smoke emission is greatest is between 6 and 10 a.m. during the period when the fires are being lighted and before they have burnt up properly.

It would clearly tend to reduce the amount of smoke if the lighting period were hurried up by using plenty of wood, and a much greater effect

would be obtained if the fires were lighted with some form of coke or semi-coke.

If now a sufficient number of normal winter days be taken, that, is, days without conditions which cause that banking up of impurities resulting in smoke-fog, the corresponding curves may be regarded as showing relative smoke production. Further, since rate of smoke production multiplied by the time gives total smoke produced, the areas enclosed between the curves and the base are proportional to the total smoke produced in 24 hours.

On week-days we have both domestic and factory fires in operation, while on Sundays we have domestic fires only, or practically so, hence the area enclosed by the curve for non-foggy Sundays deducted from that for non-foggy week-days should give, in some unit, the smoke produced by factories on week-days. If, then, W is equal to the area of the week-day curve, and S is equal to that of the Sunday curve, the proportion of domestic smoke to factory smoke in the air of London is approximately equal to $\frac{S}{W-S}$. The assumption is made that the amount of domestic smoke produced on Sundays is the same as on week-days. Two places were examined, Westminster and South Kensington. In the former the mean of 11 Sunday records and of 46 week-days were used, giving a ratio of 2·25 domestic to 1 factory smoke.

In South Kensington, 7 Sundays and 39 week-days were used, and the ratio came out as 2·15 domestic to 1 factory smoke. This is believed to be the first time a reasonably reliable method has been made available for fixing the relative importance of factory and domestic fires as sources of atmospheric pollution.

These points will show the practical value that such a research may have.

I have referred above to the drift of smoke away from the city. The following explanation of London smoke fog may be of interest. Soot particles are heavier than air and depend on the hot chimney gases to lift them up ; these hot gases can continue to rise so long as the surrounding air is colder. The temperature near the ground is usually higher than at some distance up and thus hot air rising passes from warm to cold air ; and, although on rising it expands and cools, it may always be warmer than the surrounding air and can thus continue to rise. If, however, the temperature gradient is reversed and it is cooler near the ground than higher up, the rising gases from a chimney may soon reach air of a temperature as high as their own and thus can rise no higher. The smoke collects at this level and we have a smoke fog. Whether the smoke lies down in streets or hangs as a cloud overhead will depend upon the temperature

distribution. If the smoke can rise high enough above the city it is sure to meet an air current to carry it off.

To produce a dense smoke fog about 4 milligrams of soot per cubic meter of air is all that is required. 1 milligram produces the ordinary haze which we have most of the winter in London. These quantities correspond to about 7 lbs. and 1·7 lbs., respectively, per million cubic yards. Or, if a dense smoke fog extends over the whole of London and up to a height of 400 feet something under 200 tons of soot would be present.

I have calculated that the domestic fires of London during the hours from 6 a.m. to 9 a.m. produce over 200 tons of soot. Thus it is obvious that there is quite enough to give us one of our densest fogs, if the atmospheric conditions prevent its removal.

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Dr. JAMES WHEATLEY (Salop C. C.) emphasised the importance of basing public health work on physiology. The important thing was to get overwhelming evidence of the harmfulness of a smoke-laden atmosphere, and to form a strong public opinion so as to force the Government to take energetic action. The health and fitness of the nation did not depend upon treatment, however early, but on food, exercise under good conditions, and pure air. Their efforts should be directed to improving the conditions particularly by the education of the public, whilst treatment and hospitals should be relegated to their proper position in their public health schemes.

Dr. E. G. ANNIS (Greenwich) referred to the greater need for educating the general public as to the *value* of night air as the diagrams show this air contains far less impurities than ordinary air in daytime, and also to the advantage to be gained by using low temperature carbonised coke, *i.e.*, coalite. He doubted the advantage, from the point of smoke abatement, of using oil for industrial purposes, judging from the results when their destroyers were using oil they were able to produce smoke or no smoke at will, but, apparently, this was not so in industrial concerns, as judged by a large concern, *i.e.* (L.C.C. Generating Station), in his district

Mr. DAVID R. CAMPBELL (Belfast) emphasised the need for centralized production of heat and energy, and also the encouragement of communal cookery. Use of peat was desirable as tending to some slight reduction of nuisance.

Dr. W. BERTRAM HILL (Selby) urged that additional legislation was needed to enable them to deal with excessive smoke from domestic chimneys, which, in the greater proportion of instances, were the chief offenders. Proceedings could be taken against a factory, but not a house.

Mr. D. PUGH-JONES (Cardiff) suggested the more general use of anthracite coal for domestic purposes, as this could easily be burnt in all kinds of grates. It was used in practically every house in Carmarthenshire in every type of grate.

## Pasteurised versus Clean Milk.

By C. W. Hutt, M.A., M.D., Medical Officer of Health, Holborn. (Member).

THE extraordinary importance of milk as a food compels the careful consideration of everything concerning it.

Any procedure which will enable or assist this valuable food to be consumed in a state of purity will be welcomed.

One of the greatest difficulties that we have to contend with is that milk is an excellent food for germs. In the middle of the summer the rate at which micro-organisms increase in milk is indicated by the following examination made by Dr. Eyre :—

| | Organisms per c.c. |
|---|---|
| Initial content ... ... ... ... ... | 56,000 |
| After 12 hours ... ... ... ... ... | 526,000 |
| After 24 hours ... ... ... ... ... | 20,366,000 |
| After 30 hours ... ... ... ... ... | Clotted. |

The number of organisms found to be present in raw milk taken from London dairies is somewhat startling. Of 20 samples two were found to contain less than 100,000 per c.c., three below 1,000,000 per c.c., five about 4,000,000, six seven and a half to 15,000,000; the other four contained 32, 83, 170 and 385 millions respectively.

The fact that heat kills germs has been common knowledge for many years, but it would seem that pasteurisation, when first practised by milk dealers in a rough and ready way, was carried on secretly, and, except as a means of preserving the milk, was regarded by them as a process of no value. As the practice became more general, the subject of pasteurisation was studied and its value as a means of destroying disease-producing bacteria was put forward.

Pasteurisation, as applied to milk, is a process of a somewhat indeterminate nature. It denotes the heating of milk to a temperature which may range between 140° F. and 165° F., in holder pasteurisers, in which the milk remains, and is kept at the temperature employed; or up to 180° F. in flash pasteurisers, in which the milk flows continuously through the apparatus, and the period of heating is brief.

In both cases the milk immediately runs on to coolers. Cooling to a sufficiently low temperature (40°—45° F.) is required; otherwise the bacteria surviving the heat soon commence to multiply. As a matter of practice, when the holder process is used the milk is usually heated to 145° F. for 20—30 minutes, and to at least 160° F. for one minute when the flash process is used.

Generally speaking, pasteurisation is only used when fairly large quantities of milk are dealt with by one firm. Probably the difficulty of housing the apparatus, its first cost and the cost of maintenance suffice to explain why pasteurisation is not likely to be used on farms when the producer retails his own milk, or by small firms who distribute supplies of milk produced locally.

### The Results of Pasteurisation.

Satisfactory reduction of the number of germs present can be obtained by either process, but it would be fair to say that the general results achieved are far from satisfactory.

In many cases the work of pasteurisation is carried out so imperfectly that even the keeping property of the milk is hardly increased at all ; the germs causing disease could not be destroyed if present.

In 1918 an extensive investigation was carried out by Dr. W. V. Shaw, on behalf of the Local Government Board. He visited some 25 dairies in different parts of the country, including London.

A large number of samples of milk before and after pasteurisation were examined by leading bacteriologists in London and the provinces ; although, in a few instances, the number of germs were very much reduced, on the whole the results were far from satisfactory.

Examinations were also made of the kind of germs present after pasteurisation. They showed that bacilli coli and streptococci were present. The survival of these organisms is an indication that if any germs causing disease had been present they would not have been killed.

I have given you some account of the practical results of pasteurisation in this country ; let me pass on to the questions as to whether, from the point of view of altering the nutritive value of milk and of preventing disease, pasteurisation is desirable.

Most people will agree that as regards its ordinary nutritive properties and digestibility, pasteurisation of milk by the holder process at 145° F. for 30 minutes does no harm ; but this is not the whole of the matter. For many years Sir Thomas Barlow has taught that a child must have a pint of raw milk a day to prevent the onset of scurvy. This valuable clinical observation has of late years received confirmation from the laboratory. In 1914, Dr. Funk coined the word " Vitamin " for certain substances contained in food which are essential to life ; these substances are also called accessory food factors. When they are removed from the diet animals develop various nutritional disturbances, and only regain their normal conditions when these substances are once more added to their food. Lack of these substances in human diet produces a group of diseases which are now, more or less, generally known as deficiency diseases ;

these include scurvy and rickets. Three vitamines are present in raw whole cow's milk :—

Fat soluble A or anti-rachitic vitamin.
Water soluble B or anti-neuritic vitamin.
Anti-scorbutic vitamin.

Attention as regards milk has largely centred round the anti-scorbutic vitamin. Much of the valuable work in this connection has been carried out by a New York doctor, Professor Hess, who has had opportunities of watching the children of the Hebrew Infant Asylum in New York City over a period of years.

In view of the claims of many, including the American Commission on Milk Standards, that a temperature of 145° F. maintained for 30 minutes does not destroy the chemical constituents of milk, these children were fed on pasteurised milk heated to a temperature of 145° F. for 30 minutes, and an attempt was made to leave off the orange juice that had previously been added to the milk, in order to supply the anti-scorbutic vitamin. As a result, several of the children developed scurvy. They were cured by fruit juices or raw milk.

Dr. Harriet Chick, of the Lister Institute, makes the point that a minimal amount of a vitamin will not suffice ; that you must take in enough vitamin if you are to keep well. Some children in her charge at Vienna were getting 50 grams daily of raw apple juice as an anti-scorbutic ; they, however, showed signs of scurvy. When 10 grams of raw neutralized lemon juice were substituted the children recovered, and no further trouble of the kind occurred.

Dr. G. F. Still's observations on 116 cases of infantile scurvy certainly suggest that some individuals require for the preservation of health a larger intake of vitamins than others.

Bearing these observations in mind, it is difficult to believe that the anti-scorbutic vitamin is not destroyed by pasteurisation, and that its absence from pasteurised milk is not harmful. When we consider that young babies are (or should be) fed entirely on milk, surely we ought to know if the milk supplied for the use of the baby is pasteurised or not.

As regards prevention of infectious diseases, experiments show that by pasteurisation carried out satisfactorily the germs which cause enteric fever, diphtheria, sore throat of streptococcal origin, etc., can be destroyed. However, we have seen that, as at present carried out, pasteurisation does not achieve this end. Surely it is better to go to the source of the infection, and train those handling milk up to the pitch that they will at once notify their employers of any infectious disease in themselves or families. Again, although it must be granted that occasionally infectious disease is spread

by milk, the vast majority of cases arise from contact with another person suffering with the disease.

Tuberculosis presents an entirely different problem, the seriousness of which we cannot fail to recognise if we bear in mind the recent report of Dr. Stanley Griffiths to the Medical Research Council, which showed that of the cases of human tuberculosis affecting all parts of the body, 20 per cent. of those he investigated were undoubtedly bovine in origin.

It is difficult to believe that tubercle bacilli in milk are always killed by pasteurisation.

Professor Delépine's experiments demonstrate that tubercle bacilli in milk are not invariably killed when exposed to a temperature of 185° F., even when the exposure lasts 15 minutes. The presence of living tubercle bacilli in the treated milk was proved by inoculation experiments; the tuberculous lesions not only occurred at the seat of inoculation and in adjoining tissues, but were found also in organs situated at a distance from the seat of inoculation. Even Professor Rosenau, who holds the opposite view, quotes several observers who found that tubercle bacilli were not killed at high temperatures maintained for a relatively long time—176° F. for 30 minutes (Beck), 158° F. (Levy and Burns), 76° F. for 20 minutes (Zelenski).

It is a striking fact that Mr. Nathan Straus, one of the greatest exponents of milk pasteurisation, evidently considers that for the prevention of tuberculosis of bovine origin something more than pasteurisation is required. In 1914 he expressed the view that "tuberculin tests plus pasteurisation afford the ideal protection"; and again, "the tuberculin test plus pasteurisation spells safety."

It does not appear to me to be an argument against clean milk that tubercle bacilli have on very rare occasions been found in milk of a high grade. These occurrences merely show the need for endeavouring to make our arrangements for producing high grade milk more watertight.

Some of the most cogent objections to pasteurisation must be founded on weak human nature. Surely the milkers and the persons handling milk will think: "What does it matter about grooming cows, cleanliness, and all that sort of thing, if the germs are going to be killed anyway?"

The advocates of pasteurisation certainly recommend cleanliness; but whether firms who have spent much money, time and trouble in the provision and maintenance of pasteurising plants are as likely as others to concentrate on the clean production of milk, would appear to be dubious.

Another unfortunate feature is the practice of re-pasteurising milk; this is rather common, and causes the loss of much milk in households during hot weather. Milk, even after pasteurisation for the first time, contains

products of bacterial activity, such as lactic acid and peptones ; these are the true measure of the staleness of the milk. All the time the milk is on the milkman's cart the organisms increase, and produce more lactic acid and peptones. If it is not sold, but taken back to the dairy and pasteurised again, the number of the germs may be reduced, but the lactic acid and peptone are there in increased quantity. When the milk reaches the customer it may appear quite sound, and keep this appearance for some few hours, especially if kept cool, but so high is the proportion of lactic acid present that on heating it will at once curdle.

A point sometimes made in favour of pasteurisation is that the hours of labour permitted by Trade Unions on farms delay the consumers getting milk. The farmer, it is stated, cannot as a rule keep his men late enough to drive milk from the afternoon's milking to the station, with the result that the farmer will only send milk once a day to the dairyman.

Again, for similar reasons, a delay takes place in the town ; owing to the shortened hours of labour of the milk carriers there is a difficulty in getting milk from the morning's milking delivered in towns the same day.

If the milk were clean to start with, and were cooled on the farm no difficulty would arise from these shortened hours of labour.

Advocates of pasteurisation point out that it will take a generation to get clean milk. An argument of this kind has doubtless been urged against most reforms of a long and arduous character ; but, while everyone with any experience of the subject will admit that the training of workers to produce a high grade of milk takes time and trouble, surely everybody will agree that we cannot leave the production of milk entirely in the hands of people who think handling cow dung no more harmful than touching a piece of straw.

Although much of the damage is done at the farm, we might take other steps to improve the present condition of the milk supply. Something could, with advantage, be done to prevent milk being sent unnecessarily long distances from the farm to the consumer. Milk has been brought to London all the way from Scotland, passing at least three large industrial areas where it could be consumed. Although this is an extreme case, it illustrates the point that zoning of England and Wales might be arranged ; the milk for London could then with advantage be derived from the area enclosed within the coast and a line extending from Dorset to the Wash. Birmingham would derive its milk supply from the country round Warwickshire ; Manchester and Liverpool from Cheshire and rural Lancashire ; Newcastle from Scotland.

Such zoning would necessitate increased facilities for dealing with the flush milk, but this is largely a matter of organisation ; indeed, if farmers

could be got to arrange for more of their cows to calve in September or October we should get a more uniform supply of milk throughout the year. Whether the railway companies should be asked to provide fast milk trains or not is a matter that requires some consideration. It does not seem too much to ask that in milk producing areas the churns containing milk should be kept in a shady place provided, if necessary, for this purpose.

A matter of the highest importance is the thorough cleansing of the churns, and also of the cans and vessels in which milk is conveyed from the dairy to the consumer.

I would like to express my sympathy with those concerned in the sale of milk; they have many difficulties to contend with. Doubtless the considerable majority are endeavouring to solve these difficulties, in order to supply the public with a wholesome article of food, an end which can only be achieved by sympathetic co-operation of all those concerned.

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**Pasteurised v. Clean Milk.**

By WILFRED BUCKLEY.

(PRECIS.)

THE difference between ordinary milk and clean milk from herds free from tuberculosis.

The effect on the health of the community through the consumption of clean and dirty milk.

The eradication of tuberculosis from herds of milch cows.

The effect of grading or classification of milk on the average milk producer and on the public.

The necessity of licensing milk vendors.

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Lt.-Colonel P. H. HENDERSON, D.S.O. (Eastern Command) said it appeared, from the points raised, that the only solution for producing a pure and safe milk was in the production of powdered or dried milk.

He envisaged the time when central plants would be instituted in producing areas where milk would be powdered and put in sterile containers. They were told by the readers of the papers that with the most up-to-date methods of pasteurization and clean production they could only get a milk with at least 30,000 micro-organisms per c.c. Would not powdered milk give a germ-free milk. Would it not overcome all the difficulties of transport which had been brought to their notice to-day. From his knowledge and experience of milk producers and vendors he considered it necessary to have a fool-proof process. Was it too much to expect that one day they would arrive at the exact composition of vitamines and be able to replace those destroyed in the

process of drying milk. He was not at all sure that the drying of milk was more destructive of vitamines than pasteurization.

Dr. Gerald Leighton (Edinburgh) advocated (1) a legal standard and definition of Pasteurization, (2) statutory powers to compel milk producers and vendors, &c., to use "clean" methods, or go out of the trade.

Dr. Harold Scurfield (Folkestone) said, in 1896, the Sanitary Congress at Newcastle passed resolutions in favour of free tuberculin tests by veterinary surgeons in order to eradicate bovine tuberculosis. Nothing had been done. Clean milk would not be secured for years, and we need a proper definition for pasteurization. They all ought to work for clean milk. Milk should be clean whether it was raw, pasteurized, boiled or desiccated. Pasteurization was a farce at present, and those who gave milk so treated to little children and infants as safe were living in a fool's paradise. The only safe milk for infants and young children on the market at present was dried milk.

Mr. P. B. Tustin (London) considered that intelligent education was much more necessary than legislation. Health Officers should be careful to appoint as Dairy Inspectors only men who had the necessary training and who understood the farmer's problems.

As Mr. Wilfred Buckley pointed out, it was the farmer himself and not his buildings or equipment that produced the clean milk.

With regard to the distributor, he was just as anxious to sell good milk to his customers, thereby increasing his trade. The Health Officer's duty is to see that the consumer obtains safe milk, and if the Health Officers would agree on methods of pasteurising, temperatures, etc., they would find the distributor ready to adopt their recommendations.

When we got co-operation between the milk producer, distributor and supervising authorities to the same extent as in America, we should make rapid progress and their motto should be: "To protect the Consumer and Assist and Educate the Producer and Distributor."

Major-General Sir L. J. Blenkinsop (London) referred to the excellent work which had been done by the veterinary profession during the great war. He explained that if the same percentage of wastage in animals which had taken place in the South African War had occurred in the Great War, the world's markets would have soon been exhausted, assuming that this enormous number of animals could have been transported to the various fronts. With the aid of Mallien glanders had been eradicated from the British Army to such an extent that since the Armistice there had not been a single case of clinical glanders among military animals in the United Kingdom. The men who can eradicate tuberculosis from our herds are those who eradicated glanders from our military animals, and to disparage these men is not the best way to assist them in attaining the objective we all have in view. In America they began by employing State officials to test with tuberculin, but quickly found that resort had to be made to the general veterinary practitioner, and it will be found that these are the men who will have to be trusted to eradicate tuberculosis in this country. If they are given proper support they will not fail.

## The "Position of Hospitals in relation to the New Ideals of Preventive Medicine."

By W. J. Tyson, M.D., F.R.C.P., F.R.C.S., Hon. Physician, Royal Victoria Hospital, Folkestone.

IN the middle ages the hospital was an Ecclesiastical, not a Medical institution; it was for care rather than for cure, for the relief of the body when possible, but pre-eminently for the refreshment of the soul.

There existed upwards of 750 such charitable institutions in mediæval England, and it must be remembered that the total population was smaller than that of London at the present day. This fact proves that clergy and laity were doing a good deal for social problems, although mediæval methods may appear mistaken in the light of modern and economic principles.

It is well to mention in passing that out of these 750 hospitals, 200 were given up to the treatment of leprosy: this disease raged from the 11th to the middle of the 13th century, when it abated; it became rare in the 15th, and had practically died out by the 16th century.

There is one thing which we have lost in modern times in comparison with the past, and that is in architecture. The buildings of the past, in beauty and in strength are indefinitely superior to the present ones.

The conception of the use of, and the duty of a hospital has almost entirely changed since the foundation of them. The founders were moved with pity for the sick and destitute: there was little treatment to offer, they were more or less houses of shelter; food, warmth, rest and Sarah Gamps were provided. This sort of treatment was, naturally, very inexpensive.

It would take too long, nor is it necessary, to trace down from the mediæval times to the present day the evolution of hospital treatment. Suffice to say that in my early hospital training nurses were untrained, operations undertaken with great difficulties, and blood poisoning with a great death rate was common.

The reasons for the present desire for hospital treatment are not far to reach. The question is being discussed everywhere in the Press, in public meetings and by individuals privately.

The great advance that has taken place during the last few years in medical and surgical treatment has placed the modern hospitals and nursing homes, with all their modern appliances, with resident medical staff and efficient nursing, in such a position that treatment outside these is exceedingly difficult, if not impossible.

It is these co-operative powers, possessed by hospitals, which render them indispensable, and technical treatment outside them difficult. I have no doubt that the late war has helped to impress on the minds of the great body of soldiers that were engaged in it, the real and immense value of up-to-date treatment, carried on so brilliantly and successfully by the army physicians and surgeons.

Socially, times are changing; the so-called poor are getting less poor, and the so-called rich are getting less rich, but as all classes require good treatment (the welfare of the nation requires it) some means must be found to treat all cases, and as the hospitals are best suited to fulfil these aims, they must be supported and extended.

How is this to be done? It is now generally agreed that the Voluntary system should not be done away, but that it should be altered and adapted to the needs of the times.

At a meeting of the President and General Council of King Edward's Hospital Fund for London, on 26th January of this year, the Executive Committee had been instructed to consider what principles of policy should be recommended to the Government for the preservation of the voluntary system of hospital management and control, and the following general recommendations were adopted:—

1. "That the voluntary system of hospital management and control should be preserved as being the most efficient method of providing at the least cost the best medical and surgical treatment combined with advance in medical knowledge and practice."
2. "That any policy or absence of policy which stopped voluntary contributions, and did away with voluntary management would bring upon the public funds not only the cost of the hospitals, but also additional cost of paid management, of general supervision by some central public department."

The report goes on to say:—

> "It is clear that as the demand for hospital treatment grows, the voluntary hospital system must either expand so as to meet the whole of that demand itself, or submit to the establishment of other agencies to compete with it in the attempt to meet the whole of the need, or confine itself to meeting the whole of the increase in the particular kind of demand which it may be best fitted to meet. Different decisions between these three courses may be appropriate to different localities or to different kinds of hospitals. But correct decisions there must be, if the voluntary hospital is to keep its proper place in the growing service of the country."

As regards the number of hospital beds required in any town or district, it has been estimated that at least three beds per 1,000 are necessary.

Now the poor are fairly provided for, and the rich can enter private nursing homes. The crux of the situation centres around the provision of adequate medical treatment, both general and specialist, for the lower middle classes, whose incomes will not stand the strain of consultation, operation fees, and nursing home charges.

Now, *how are funds to be obtained* so that everyone may enjoy the best modern treatment ?

First, let us remember that our hospitals are not convalescent homes, but are for cases that require special treatment ; also, never forget the mere number of patients is not the test of a hospital's use, but the number who are rendered fit for work.

It is hardly possible to ask our hospital in-patients to pay their full expense incurred, but this can be done, and doubtless before long will be, by the nineteen people who are well paying for the twentieth who is ill.

There are several plans, even now before us, of meeting our expenses. One started in Brighton, is called the *Sussex plan*, by which a very large number of persons subscribe to a central fund; a pound a year. The General County Hospital with all the other hospitals, has joined, so that every kind of special treatment can be given, and fees are paid to the consulting practitioners as well as the ordinary fees to the family doctor. Then a *Labour Hospital* has been started at Golders Green, where 100,000 members pay a penny per week, and one shilling entrance fee. The hospital is paying its way and has a surplus of £1,000—£2,000 in hand. The hospital comprises 130 beds, and possesses a large out-patient department ; it has an excellent medical staff.

My colleague, Dr. Wilgress, has suggested a plan whereby the whole of our hospital expenses might be met by employing and using the organisation of the Medical Insurance System, which at present is only half fulfilling the duties, which were promised when it was introduced.

There is another source from which money may be, I think, rightly obtained. The Voluntary Hospitals' Committee, presided over by Lord Cave, has presented an interim report on the question of contributions to hospitals out of the Valuation Surplus of Approved Societies. There is a present surplus, estimated at 7 millions. It is suggested that approved societies should make a weekly payment towards the cost of their members who might become in-patients, or a quarterly or yearly subscription.

The voluntary assent of the approved Societies, however, must be forthcoming before those payments are made ; for under the terms of the National Insurance Act, the Minister of Health has no power to order such payments

The hospitals can advance very good claims for such payments. They can demonstrate that through their work they have helped to produce this welcome surplus. Seldom in fact is the national work which the hospitals really perform realised.

In a recent address given by Sir Napier Burnett in Birmingham, he pointed out that a patient in the hospital is of value to his wife and family, to his employer, to his insurance company, to the State, and to the municipality in which he lives.

### Amending the Act?

Are the hospitals thus to suffer? The annual income under the National Health Act amounts approximately to upwards of 26 millions. The Annual Expenditure absorbs 17 millions. There is accordingly, a large margin, and the question arises whether the original Act should not be so amended as to empower Approved Societies to pay periodic contributions to hospitals for their members.

If the Approved Societies, in their own good judgmen t, should decide to assist hospitals to-day by making direct contributions, they would, after all, be carrying out not only the letter but the spirit of the Insurance Act.

The humanitarian spirit has always appealed to the British public. The cry of a distressed nation has always found a ready response in the hearts of the British people. And so to-day, the self-sacrificing work performed, day in, day out, in the national repairing shops, that is, our hospitals, will appeal to their best instincts, and Approved Societies will, I have little doubt, willingly agree to Lord Cave's recommendations.

Unfortunately there is no general hospital system in England. The work is, to a considerable extent, unorganised and insufficient. We particularly lack beds for early mental cases, and for maternity cases; for the latter cannot be dealt with in overcrowded, insanitary or unsuitable tenements. Relatively speaking, the need for similar provision in rural districts is equally great.

The old idea that only critical, advanced or emergency cases should be admitted to hospital must be discarded. *Essential treatment*, not otherwise obtainable, should be the criterion.

I have already suggested, or rather others have done so, how these modern and present views of hospital treatment can be carried out for the benefit of all classes of people.

There is another means of providing this great want, which has not yet been mentioned, viz., our millionaires! America has set us a good example in this matter, by not only building great hospitals of every description, but endowing the staffs.

## The Hospital and the Primary Health Centre in relation to a Health Service, from the standpoint of the General Practitioner.

By E. L. Martyn Lobb, M.S. (Lond.), F.R.C.S. (Eng.).

THE title of this paper suggests a means to an end, and I will first consider the end.

A Health Service contains a wonderful ideal in three words. The finest and most valuable national asset is the national health. A Health Service should work for and secure the health of high and low, rich and poor. More than that, a Health Service must work to maintain health rather than to cure disease. The benefits of medicine and surgery must be made available to all in the earliest stages of a deviation from health, for that it is easier to cure any illness in an early stage rather than in a late one is a truism which needs not to be laboured. A Health Service is, or must be, an organisation by means of which the full resources of modern knowledge are placed at the service of anyone not in good health and at the service of any member of the profession endeavouring to make the earliest possible diagnosis of a departure from health. A Health Service must not involve a whole time national service, nor must it ignore the varying capacity of the individual to make a return for services rendered.

So much for the end. Now as to the means.

Firstly, what now are known as preventive and curative medicine can in no wise be allowed to be separated, for the ends they serve are one. My friend and colleague, Dr. C. W. Ponder, will deal with that aspect of the health service which is more particularly connected with his specialism from the point of view of the Public Health expert. It is my privilege to speak concerning the point of view of so-called curative medicine.

The title of this paper mentions the Hospital, the Primary Health Centre, and the General Practitioner. On these three agents the curative services depend. The interdependence of the three and the general lines of their efforts have already been set out in Sir George Newman's memorandum and in the interim report of the Consultative Council.

Better still, the principles of those papers have been translated into working facts by the genius and enthusiasm of Dr. J. Middleton Martin, of Gloucester. Where the rest of us have hoped and dreamed, Dr. Martin has insisted and accomplished, and I offer to him the respectful admiration of the striving pupil for the acknowledged master. In November, 1919, fired by Sir George Newman's memorandum, I ventured to set a-rolling the controversial ball of a health service for Maidstone and district. We

have had many meetings in the past eighteen months, and we still have no organised health service, but we have, at least, an elected health council which is making its first work the consideration and organisation of such a service. By the courtesy and encouragement of your secretary, Dr. W. J. Howarth, I am here to-day, but I still feel that I am here under false pretences. I have always considered that he who reads a paper to a learned society should do so because he has some new thing of value to impart, and I have never yet found myself in that enviable position. To-day I make a début without satisfying my own criterion, and I confess my delinquency to you here and now. In the past eighteen months I have met with difficulties, and I foresee other and greater ones. It is of my difficulties that I speak, and to you that I look for advice as to how to meet them.

"Public health," says the motto of the New York Department of Health, "is purchasable." Precisely! And there's the rub. Given unlimited finance I take it that the foundation and continuance of an adequate health service would be a comparatively easy affair. Unlimited finance is, however, an affair of mythology, and even Phrygian Midas begged release from his gift and subsequently, though for another reason, died of shame because his ears grew long like an ass. To-day, finance is anything but unlimited. Alike from tribune and press, as well from the man in the street as from the grim guardian of our pass-book's skeletons, come unceasing calls for rigid economy and retrenchment. It would seem that the great renaissance of medicine which we are witnessing could hardly have occurred at a more inopportune moment. We are become a second House of Israel, and must fain make bricks without straw.

Whenever I have been able to persuade people that the idea of a Health Service is not a subversive and anarchistic doctrine, I have been met invariably with a seecond line of defence—"Yes; it sounds very nice and pretty, but who's going to pay for it?" The hospital says: "If we are going to throw open our resources to all, irrespective of class, we must have extensive extra accommodation and equipment. We cannot bear our present burdens, still less dare we add to them." The municipal authorities, the public, the ratepayers applaud the abstract idea of primary health centres, but dismiss it as a fantastic mirage; "Not another penny from us," they cry. The practitioner caught between the upper and nether millstones of high prices and diminished spending capacity, views the scheme as an insidious attempt of socialistic dreamers to rob him of the little he yet may earn.

Public health is purchasable, but we have no money. Is that, then, to be the end? Is there no other thing which we may barter in kind to obtain our desire, despite our poverty? I suggest that to the former question we

must return a ringing "No," and that to the latter we may, if we will, advance a considered "Yes."

"The common problem, yours, mine, every one's,
Is not to fancy what were fair in life
Provided it could be—but, finding first
What may be, then find how to make it fair
Up to our means—a very different thing!"

It is certain that neither this year nor for many years can we, as a people, afford or attain to a perfect Health Service. But we may yet make a start. If each and every one would give to the fund of the common weal interest, readiness to work, tolerance, and freedom from suspicion . . . ? With the wealth of such gifts what wonders might not be wrought? The schemes of the interim report would cost more money than the country can afford. How far along the road to an ideal Health Service can we get with the aid only of existing facilities? It is to this point that I address myself.

First, as to the Primary Health Centre, which is generally admitted to lie at the root of an efficient Health Service. I have before me Schedule 10 of the Gloucester scheme, and I note that in the whole county only four new out-stations have been established. For the rest, use has been made of existing institutions. That seems to me to be the key to the present situation in regard to Primary Centres. Full use must be made of anything even remotely resembling a hospital in any given area, and only under the greatest pressure can we afford to establish a new centre or out-station. In some parts of the country, Maidstone and district for one, there is not the same number of existing institutions as in the Gloucester area, and the problem is correspondingly more difficult. Here is a matter where co-operation becomes vitally necessary. Consider the case of a large village or small town with no existing hospital. In this place there is already a medical inspection of school children, very probably an infant welfare centre, possibly a branch clinic for pensioners, and almost certainly one or two medical men. All these agents are carrying out their work independently, each with their own costs for housing and maintenance; costs already defrayed from existing sources. Their work is done at different hours and mostly on different days. It is surely not putting too great a strain on *amour propre* or personal independence to ask these agents to combine, pool their resources, diminish their expenses, conduct their several activities under one roof, and with the balance of their common funds maintain the nucleus of a Primary Health Centre. The village hall and the school premises may well come to the aid of the common weal, where no other adequate building is available, and here both the ecclesiastical and educational authorities have a great opportunity for public service.

Next as to the hospital. There is not, I suppose, a hospital in the country which has not cause to complain of inadequate premises, and that long waiting list which Sir George Newman has branded as "an anachronism, itself a condemnation of our inadequate hospital provision." It appears at first sight that it is not possible, out of the present funds, to provide the additional facilities for diagnosis, advice, and treatment which would be required by an adequate Health Service.

But is it so? The crowded premises and the waiting list are, I suggest, for a large part a matter of inadequate organisation rather than of inadequate provision. Much has been written and spoken of hospital abuse, and certainly the abuse of a hospital's charity by those who could well afford to pay for the services they receive is a matter which demands the most serious and urgent attention. I hope that the day of a sliding scale for payment by patients to a hospital is not far distant. But there is another abuse of hospitals, equally grave, and possibly more harmful to their work. There are far too many treatments being given in hospital which could just as well be carried out in the patient's home, or in a primary centre, or in a convalescent home. Every treatment so given in hospital is an abuse of the hospital and a curtailment of its power for good.

It is commonly assumed that the primary health centre would only make increased demands on the hospital, but I would point out that by filtering cases referred to the hospital, by carrying out the treatments advised by the hospital after reference, and by diminishing the number of cases fit for hospital as a result of its preventive activities, the primary health centre would go far towards relieving the congestion of hospitals which is now so apparent.

If the average stay of a patient in hospital be taken as twenty-one days, it is probable that at least ten of those days might well be spent out of hospital provided that intermittent medical inspection and elementary nursing were available during the period. This line of thought has been much developed by Lord Knutsford, and his solution is that every hospital should have attached to it a convalescent section in the country where rent, rates and upkeep are alleged to be less than in the town. That is a pretty idea, but for most hospitals it involves building, and building to-day is taboo. I suggest that full use is not being made of existing convalescent homes, and that, in some cases, improper use still further diminishes their power. It is time that a sort of Domesday Book of England's convalescent accommodation were compiled, and that to every hospital, according to its size, a corresponding fraction of the available convalescent bed accommodation should be assured. To-day all over the country the Poor Law infirmaries

are largely empty, and, in many cases, are being closed by the local authorities. If the stigma of pauperism were removed from the name, and their doors were thrown open to the hospitals for the latter's convalescent patients, here is a means ready to the hand to reduce the average stay of a patient in hospital by one-half or two-thirds ; in other words, to double or treble the effective capacity of the existing hospitals.

The out-patient departments of hospitals, too, are unnecessarily overworked. It is wrong that for months at a stretch a medical specialist should be required to write " Rep. mist." for the dyspeptics, neurasthenics, and debilitated who throng the waiting hall. Only such treatment as the hospital alone can supply should be furnished after the first visit by a patient. Treatment other than that, i.e., such treatment as can be given as well outside as within a hospital, should be furnished by the panel, the private practitioner, or the poor law.

I would also put forward a plea for reconsideration of the attitude which at present forbids the admission of cases requiring even the simplest dressing to so many tuberculous sanitoria and convalescent homes. This goes far to stultify their value and to engorge the hospital waiting lists.

Lastly as to the the general practitioner and the practitioner acting in a specialist or consultant capacity. We are an altruistic profession and at heart are proud of our altruism, though at times a cynical bitterness is apt to read " folly " for " altruism." There is, however, another side to the matter which cannot be ignored. In these times it is unwise and unfair to ask the profession to diminish their means of livelihood for the sake of an abstract and generally conceded ideal. Not once, but many times, and always with truth, has it been laid down that the goodwill and co-operation of the general practitioner are essential to any scheme for a Health Service. If the practitioner can be shown that the proposed service will provide an adequate return for his labours and will allow him to conduct those labours on lines agreeable to his professional independence, the greatest of all obstacles will be removed from the path. This question of payment for services rendered to the primary and secondary centres worries me. I can see that judicious and willing co-operation between the Insurance Commissioners, the Guardians, and the Ministry of Health will cover part of it, but I am still at a loss to find a means to cover the residue. I look forward eagerly to hearing from Dr. Middleton Martin how he has solved the problem. Perchance, like Bunyan's pilgrim, he has " kept in the midst of the path " and proved that the lions in the way " are chained, and are placed there for the trial of faith where it is and for the discovery of those that have none."

In conclusion, I wish to advocate the foundation and recognition of

Local Health Councils. The problems of a Health Service cannot be adequately considered and solved by the medical profession, or any section of it, alone. The laymen who control the local activities of the education, insurance, infant welfare, poor law, and other authorities, have waiting for us knowledge and experience with which we cannot dispense. We cannot and shall not make the most of the available resources without their help, and we must, therefore, from the first, have the benefit of their advice and approval. In Maidstone and district we have now a local health council composed of representatives of every branch of professional activity, and also representatives of the various county and municipal authorities interested in or working for the health of the public. I hope and believe that this Council will be of the greatest possible service to the cause. I am sure that its power would be infinitely greater were it one of a series covering the whole country. I have been told that the organisation of the British Medical Association, on the one hand, and the Health Committees of municipal and county authorities, on the other, are amply sufficient for the purpose, and that a council such as I urge is an unwarrantable entrenchment upon their ancient preserves. I deny both these assertions. A Health Service is, to quote the words of the interim report, "an undertaking which can be at once begun and steadily proceeded with, and at a rate proportional to the enlightenment and determination of local public opinion—lay and medical." To secure that enlightenment and to confirm that determination I submit that lay and medical men must meet and work on equal terms on a local health council. At the meetings of such a council the especial and peculiar needs and difficulties of a district can be discussed with first hand evidence available from those specially versed in each branch of them. From such discussions only good can spring.

Eighteen months ago I thought that the dawn of a real Health Service might well be at hand. To-day I feel that there is need for us to heed the call of sober reality rather than the lure of unfettered imagination.

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Dr. James Wheatley (Shrewsbury) said that his principal reason for taking part in the discussion was that in Shropshire they had a scheme for dealing with crippling conditions, which, in some respects, might be applied to general hospitals, with advantage. Before dealing with this scheme he would like to point out that " Health Centre " was hardly a proper term to apply to an institution dealing entirely with the sick. By such measures it would never be possible to build up a fit and healthy nation. The centres described by Dr. Lobb were centres for medical treatment, and should so be described.

The Shropshire orthopædic scheme consisted of a hospital, 14 after care centres, and a body of health visitors who acted as scouts. The health visitors searched out the cases and referred them to the after-care centres, from which they were drafted off to the hospital. The after-care centres carried out the treatment after discharge of patients from the hospital, and saw that the patients went back to the hospital when necessary. These centres were open once a week, a skilled orthopædic nurse always being in attendance, and the medical officer of the orthopædic hospital being in attendance at somewhat longer intervals.

Probably similar organisations were required in connection with general hospitals, so that a proper selection of cases for admission could be made, and the patients got in as early as possible, and particularly so that they might receive supervisory care after discharge. These organisations could not be properly provided unless the hospitals were linked up closely with the public health service. By such arrangements the present hospital accommodation might be utilised to much greater advantage, and considerable economy of beds made.

Another important matter which would lessen the amount of hospital accommodation required was the provision of district nursing service, composed of well-trained nurses, well educated and trained in public health. The district nurse should be at the top of her profession, and her training in hygiene and public health should be a real one. In a district so provided many cases that should otherwise be removed to a hospital could be kept at home. There was a great advantage in treating persons at home where this could be done without detriment. The influence upon the home was good, and the teaching of the nurse should be of great value. There was no corresponding improvement to the household when the patient was removed.

Dr. H. HANDFORD (Nottingham) advocated the closer co-operation between the great general hospitals and the authorities engaged in preventive medicine. Much of the work of the general hospitals was undertaken not only to relieve suffering, but to restore patients to health and efficiency, and by early effective treatment to prevent crippling disease. The increase of hospital expenditure was due mainly to the remarkable advances and developments in hospital treatment, which were expensive, and to the growth of special departments. The latter were wanted, but the cost was great.

The great question was whether hospital treatment of a preventive character was to be undertaken in " Ad Hoc " institutions financed by the rates, or by the closer co-operation of the voluntary hospitals.

## Gloucestershire Scheme for the Extension of Medical Services.

By J. Middleton Martin, B.A., M.D., D.P.H., Medical Officer of Health, Gloucestershire County Council (Fellow).

### Introduction.

SHORT as is the history of modern preventive medical science, it has passed through an intensely interesting course and has reached a stage in its evolution which can scarcely have been anticipated by its founders little more than half a century ago. In its early days, environmental influences, drains especially, held the imagination to such an extent that they were regarded as causal agents of all preventable disease. After many years came Pasteur, Lister and others almost innumerable, who gave us exact and reliable bases for much of our work. With the revelation of the actual causes of many diseases, the methods of preventive medicine were adapted to take advantage of the new knowledge. The stage of isolation hospitals and preventive inoculation was reached but, dramatic as many of these modern discoveries were, the foundation of the latest developments was really laid, though the significance was far from fully appreciated, at the end of the eighteenth century, when Jenner discovered the value of inoculation with cow-pox in the prevention of small-pox.

The next stage of preventive work in medicine was reached when the importance of the personal factor became more and more appreciated, and as a natural outcome the scope of preventive medicine was extended from diseases introduced from outside to those conditions not due to external causes and not infectious, the bad effects of which are preventable, if the conditions are treated in their early stages. One important result at this stage was the initiation of medical inspection of children attending Public Elementary Schools, by the Board of Education, under the guidance of Sir George Newman: the short section of the Education (Administrative Provisions) Act, 1907, which laid this duty of inspection on Local Education Authorities empowered them to provide treatment in its broadest sense. For some twelve years inspection has been proceeding and many thousands of children have been examined, with the result that the preconceived ideas of the necessity for early treatment to avoid permanent and dangerous effects were clearly confirmed. Many authorities, especially in large towns, arranged for the treatment of various defects under these permissive powers which in the latest Education Act (1918) were changed from "powers" to "duty," so serious did Parliament regard the revelations of the School Statistics and recruiting records.

Meanwhile intensive campaigns, with a view to the control of two groups of diseases, tuberculosis and venereal diseases, had begun and in both instances treatment has an important place.

Mention must also be made of two further factors, both of which are associated in the origin of the Scheme now to be described. The first is the wide-spread machinery for the prevention of infantile diseases and the infantile mortality rate; this rate, in spite of much general discussion and valuable work in various parts, remained at practically the old figure of about 160 deaths per 1,000 births up to the end of the last century, but in the last twenty years has fallen to 80 (1920), a remarkable fact which it is scarcely possible to avoid connecting with the efforts of the nurses known as health visitors and the work of the Maternity and Child Welfare Centres. The other factor is the need of making adequate provision for the care of the ex-service men who received injuries and developed illnesses whilst, or as the result of, taking their share in the great war of might against right.

From the above very brief sketch leading up to the position at the present time it will be clearly seen that local authorities (including War Pensions Committees) have to provide medical and surgical treatment for several groups of persons and a variety of diseases and defects, and the object of this paper is to show in what manner it has been arranged in one county area.

At this point it is necessary to emphasise the difference between the circumstances of a large town and such an area as that of a county: the difference is concisely and clearly shown in the following comparison between a large town like Bristol and the neighbouring County of Gloucester. In the former there are over 13,000 persons per square mile, while in the County the number is only 268, in other words, while each person in the County has, on the average, 11,560 square yards to himself, the City man could have only 236·5 square yards. The practical result from the point of view we are now considering is that from the aggregation of population in towns, it is perfectly simple to open a treatment centre for any special purpose for, within range of the centre, there will be a sufficient number of persons to provide enough work. Another—inestimable—advantage possessed by these large towns is the existence of the large general hospitals founded by the generosity of bye-gone generations, accessible to all the town inhabitants under very easy conditions. These hospitals are also available for a comparatively few residents in the neighbouring Counties who happen to have easy lines of communication or can be taken to the hospitals in ambulances when suffering from serious accident or illness: there are also scattered over the Country, Cottage Hospitals—11 in Glouces-

tershire, with a population of 330,000, mostly founded since the Crimean War, which appears to have been the exciting cause of their institution. In addition to these medical centres, there are distributed all over the Country, medical practitioners and a steadily increasing number of district nurses.

### Schemes of Treatment.

As each new duty was placed on a Local Authority, the simplest and most obvious course for providing treatment was to open a suitable number of centres and to appoint a special officer or special officers, and this has been the procedure generally. First a School treatment service, followed in turn by tuberculosis officers, venereal disease officers, maternity and child welfare officers, with a corresponding multiplication of treatment centres. Doubtless this is a perfectly proper and correct procedure in large towns where there is room for such multiplication of specialist services but, if—as they should be—the advantages are to be brought within reach of the inhabitants in a County area, such a course is impracticable and uneconomical. In some County areas the difficulty is, to some extent, overcome by appointing treatment officers who are School Medical Inspectors, Tuberculosis Officers, Venereal Disease Officers, and Maternity and Child Welfare Officers. Even so, it can scarcely be said that with peripatetic officers the County inhabitants generally can have the advantages for which they pay.

### Origin of the Gloucestershire Scheme.

A review of such facts as are outlined above led to a consideration of the possibility of utilising and developing the existing agencies, basing a general scheme of treatment on the large general hospitals which are the recognised centres of the finest medical and surgical work in the Country, and in April, 1918, such a Scheme for Gloucestershire was put forward to the Ministry of Pensions, where—I heard very many months later—it has been carefully pigeon-holed.

In the development of the scheme the first difficulty encountered was, on the one hand the number of authorities, central and local, and on the other the different medical bodies (Hospitals and General Practitioners) whose co-operation it was necessary to secure. That it has been possible to reach the final stage of putting the Scheme into operation is largely due to the initial impetus given to it by the Staff of the Cheltenham General Hospital, to whom is due the central idea of utilising the general practitioner, and to the generous support of the Gloucestershire Branch of the British Red Cross Society who made a grant of £7,000, one half of the estimated cost of providing the treatment centres, called Out-Stations of the General Hospitals.

About the time the Scheme was complete the Minister of Health appointed the Medical Consultative Council to advise broadly on the policy to be adopted in the development of medical and allied services in the future and this Council, in their interim report presented to the Minister in May, 1920, gave the Gloucestershire Scheme as an illustration of the services which, in their opinion, should be provided for the whole country.

The scheme, in its final form, was placed before the Ministry of Health on 3rd October, 1919, and their formal approval, in which the Board of Education concurred, was received on 15th April, 1920. Since that date all details have been settled and the first Out-Station was opened on 23rd May, 1921. The full scheme provides for 52 Out-Stations and when they are available, there will be on the average one within three miles of every part of the County : 32 were to have been opened this year, but, in view of the special need for economy at the present time, arrangements have been made for twelve, the remainder to be provided gradually.

## Description of the Gloucestershire Scheme.

*Scope.*—The services provided by the scheme include treatment—mainly out-patient—in connection with the following :—

1. Defects of school children.
2. Tuberculosis.
3. Venereal Diseases.
4. Maternity and Child Welfare.
5. Ex-service men.

The machinery of the scheme lends itself to the inclusion of any additional medical services which it may be desirable to add in the future.

*Basis of Services.*—The scheme is based on the large General Hospitals in Bristol, Cheltenham and Gloucester and the smaller General Hospital in Stroud, each providing consultant services for the area of the County surrounding it and acting in all ways as the parent institution of the Out Stations in their respective areas.

*Local Centres.*—These include the Cottage Hospitals (of which five have accommodation for out-patients immediately available), Tuberculosis Dispensaries (whose function is now enlarged) and special buildings (the new being adapted sectional huts no longer required for military purposes). They are Out-Stations of the General Hospital for their area and are at present equipped in the simplest possible manner pending practical experience of the requirements.

*Staff.*—The medical staff consists of the local practitioners, who (when there is more than one) will take duty as Medical Officers in turns for six months at a time (in the order decided by themselves), and the visiting

staff of the Hospitals : the latter attend at the Out-Stations to see groups of cases referred to them by the Medical Officers.

The nursing staffs are local nurses, either the nurses of the Cottage Hospitals or the district nurses.

*Openings of the Out-Stations.*—Until experience has been gained of the requirements, each Out-Station is opened for the attendance of the Medical Officer at a fixed hour on one day a week and at other times for consultations and intermediate treatment by the nurse, according to the work to be done.

*Attendance of Patients.*—School children found by the School Medical Inspector to require treatment will be referred to their usual medical attendant, who will either provide treatment himself or will recommend that it be obtained at the Out-Station ; children suffering from such conditions as impetigo, etc., will similarly be referred by the Head Teachers.

Persons suffering from tuberculosis and venereal diseases will be referred by the Tuberculosis Officer and Hospital Venereal Disease Officers to Out-Stations for such treatment as can suitably be given there. Similarly, treatment will be given to ex-service men sent by the Ministry of Pensions and will include massage, etc., when the Ministry provide the funds.

*Drugs, etc.*—An arrangement has been made whereby drugs, etc., will be supplied on prescriptions by the Medical Officers, either by the Hospitals or local chemists at National Health Insurance rates.

*Records.*—The records have been reduced to the simplest form possible and include only :—

1. A Register of Openings and Attendances of Staff.
2. A Register of Attendances of Patients, showing the group to which they belong.
3. A simple form of Case Paper for each patient.

*Financial Arrangements.*—The expenses (apart from the capital charges to which the Red Cross Society have contributed one-half) will be divided between the various Committees according to the attendances of the different groups of case for which each is responsible, the estimated cost for 1921-2 being slightly below £5,000.

The Consultants are remunerated from inclusive sums paid to the Hospitals : the Medical Officers receive one guinea an hour or part of an hour they attend at the Out-Stations, and the Nursing Services are paid for at the rate of 2s. an hour or part of an hour.

*Medical Advisory Committee.*—This is rightly regarded as one of the most important elements of the Scheme, for the formation of the Committee ensures that all medical matters are considered by a body fully qualified for the work they have to do. It consists of equal numbers of

medical officers of out-stations and representatives of the Hospital staffs, with the Executive and Clinical Medical Officers, the latter being the Hon. Secretary. The Committee is represented on the Managing Body by the Chairman of the Committee, or, in his absence, the Vice-Chairman.

*Board of Management.*—The Managing Body, responsible to the County Council, consists of representatives of the County Council and its Committees, the General Hospitals and the Red Cross Society, with the addition of the Chairman of the Medical Advisory Committee.

*Conclusion.*—The above account of the Gloucestershire Scheme is sketchy from the necessity of condensing its origin and description in a short space, but it is hoped that the essential points have been made sufficiently clear to demonstrate the manner in which the circumstances of a County area have been met by increasing the responsibility of existing agencies instead of appointing new officers and thereby detracting the interest of practitioners in certain classes of case. That the close co-operation of medical men—consultants and practitioners—necessitated by the Scheme must tend to increased interest in their work and improved service to the community cannot be doubted, and the manner in which the Medical Advisory Committee have accepted their responsibilities and the persons associated in the Scheme have approached their duties, promises success, though the Scheme has been in operation too short a time to speak definitely as to the results.

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Councillor J. C. JULYAN (Mayor of Poole) said that he was in favour of a State medical service. He thought that, notwithstanding all that had been said to the contrary, the great Friendly Societies of the country had for many many years been in the forefront in supporting the voluntary hospitals, and interesting themselves in public health matters. Also at present a good deal of waste in effort and money was caused by the overlapping that prevailed through the present system, whereby the county authority was responsible for certain administrative work that could well be dealt with by the local council. He felt that in any well organised health service (preventative and curative) the Poor Law Union should be the basis of area. There was also a crying need for the establishment and equipment of research laboratories. Much better results could be obtained from the existing funds provided for health and hospital services by closer co-ordination particularly on the side of preventive work.

Dr. R. H. MAKGILL (New Zealand) said that the hospital service in New Zealand was a State service, wherein the State, out of taxes, and the local authorities, out of rates, share equally the cost of the hospitals. There was a local hospital board, elected by the ratepayers, which was in charge of the hospital, the Health Department exercising general supervision.

There was no lack of interest shown on the part of the people of the hospital district, on the contrary they were very proud of their hospitals and made every effort to keep them up-to-date. They bitterly resented any

appearance of encroachment on their rights on the part of the Central Department. It was the policy of the department to develop the hospital scheme very much on the lines of the Gloucester organization. Briefly this included a central base hospital, with subsidiary hospitals in the country, sending in special cases which they were unable to treat adequately, small cottage hospitals treating emergency and lying-in cases in still smaller centres, and finally the district nurse in the back blocks, who was generally also a midwife and was a very valuable officer in a new half-developed country.

Dr. J. Holroyde (Chatham), as a medical officer of health and a member of a hospital committee was in favour of a State medical service, but the time was not yet ripe. The panel practitioner was making a larger income under the present system, and the present scale of payment had placed a salaried service in the background. The preventive aspect was not touched upon in the papers, and the relative position of those who were concerned in preventive and curative medicine needed definition. Hospital treatment touched public health at one point, in that it supplied an environment which aided recovery and which was lacking in most homes to-day. What were the essential facts in regard to Hospitals? They were: shortage of beds, increased need, increased cost, insufficient funds.

Voluntary efforts could not meet the deficiency. He advocated a system of payment by inmates according to income. Hospitals were used to-day by a class of person who should not be the recipients of charity.

Dr. T. Shadick Higgins (London) said that he desired to ask Dr. Martin a question in regard to the Gloucestershire scheme, which was so generally admired. He (Dr. Higgins) was looking for the germ of the system whereby every man, woman and child in the country would have the services of a family practitioner, having at his disposal hospital facilities and the other facilities needed in any complete public medical service. He gathered that the basic fact of Dr. Martin's scheme was the grouping together into an individual institution (or centre) of the preventive and curative treatment of the classes of persons who were already being dealt with by sanitary and county authorities, such as young children and mothers, school children and tuberculous persons. He asked what Dr. Martin had in his mind as to the relation of his scheme to the general treatment of persons insured under the National Insurance Act and of persons at present uninsured. He had not gathered from Dr. Martin's interesting paper this particular point, which was, in fact, the very matter on which medical officers of health were anxious to get information, so that they could hasten in their own districts the advent of an adequate medical service.

Dr. W. Bertram Hill (Selby) said that the papers read did not deal in any way with the preventive side of the question—but solely with the curative aspect. There was a sharp line of distinction between preventive and curative medicine, and the general practitioner had apparently not yet realized this essential point. They did not yet realize that the object of preventive medicine was to prevent hospital beds being occupied. The health of the individual should receive attention long before there was any question of hospital beds being occupied. The great need to-day was the education of the general practitioner in the principles of prevention. A complete scheme of preventive medicine was the first essential.

## CONGRESS AT FOLKESTONE.

### SECTION B.—ENGINEERING AND ARCHITECTURE.

#### Designing a New Township for 120,000 Inhabitants.

By G Topham Forrest, F.R.I.B.A., F.R.S.E., F.G.S., Superintending Architect of Metropolitan Buildings, and Architect to the London County Council (Member).

IN connection with the Government's post-war Housing Scheme, the London County Council gave exhaustive consideration to the question of the housing needs of London as a whole, and formulated a comprehensive programme embracing—

(1) The development of existing estates.
(2) The acquisition and development of new estates.
(3) The clearance of insanitary areas and the rehousing of the displaced population.

The greatest need was in the eastern part of the county, and it was decided, therefore, to purchase a new estate eastward of London.

The Council, with the approval of the Ministry of Health, acquired a tract of land now known as " Becontree," extending for two and a quarter miles eastward of the developed portions of Ilford and Barking towards Becontree Heath and the village of Dagenham, and about two and a half miles between Chadwell Heath in the north and the Ripple Road in the south. It was originally proposed to develop this area, comprising nearly 2,800 acres of fairly flat agricultural land, into a new township, with a population of about 120,000, and to endeavour to complete the scheme within a period of about five years.

Even in pre-war days, when there was a plethora of both labour and materials, and when it was possible to build without financial loss, such a proposal would have presented many difficulties. But under post-war conditions, not only are these difficulties intensified, but others, no less serious, present themselves, particularly in regard to the paucity of skilled labour and building materials. Although recently there has been a slight improvement, it cannot be anticipated that during the next four or five years there will be any approximation to pre-war conditions.

In view of the difficulties and of the fact that a time limit was imposed in regard to the completion of the State-aided houses on the Estate, it was

essential to proceed immediately with the preparation of the lay-out plan, and certain governing conditions in relation to the design of the township were formulated. This paper, therefore, deals with—

A. The conditions governing the design.
B. The design itself.
C. The work now in progress on the first section of the Estate.

### A. The Conditions Governing the Design.

The site is fairly flat, with a gradual slope from north to south, and, with the exception of Parsloes Park, is practically devoid of any features of outstanding character. It is well served by roads, and the Great Eastern Railway passes the northern boundary of the Estate, while the London, Tilbury and Southend Railway traverses the Estate about half a mile from its southern boundary.

The tendency of local development has been towards the boundaries of the Estate, along the lines of the existing railways, as may be seen by a comparison of the Ordnance sheets of 1897-8 and 1920-1. In the case of Ilford, development has extended to the western boundary of the Estate, and the City Corporation's Housing Scheme is in progress at Barkingside. Two new railway stations on the G.E.R. main line (Seven Kings and Goodmayes) have been constructed, and a new branch line has been built linking Woodford and Ilford. Recreation grounds have been formed at Seven Kings, Goodmayes and Ilford. Barking has been developed in an easterly direction, and now approaches to within half a mile of the Estate, and the Barking Housing Scheme is practically contiguous to the Council's boundary. There has been a considerable development in the neighbourhood of Chadwell Heath to the north of the Estate. Romford has extended to the south and west in the direction of Becontree, and the Romford Housing Scheme, adjoining the Council's boundary at the south-eastern corner of the Estate, is in progress. In the neighbourhood of Dagenham Station, Cambey Estate is in course of construction.

After careful consideration of the foregoing the following governing conditions were formulated :—

(i.) An "open belt" should be provided, particularly on the western side of the Estate, in order to secure a breathing space between Ilford and Barking on the one hand and the new township on the other.

(ii.) Wherever possible, existing roads, farmhouses and cottages should be retained and incorporated in the general scheme.

(iii.) Advantage should be taken of the Parsloes Park in the centre of the Estate to form a central park for the new township.

(iv.) Regard should be had to the aspects of modern town planning as embodied in schemes such as the rebuilding of San Francisco and the development of Chicago ; and comparison should be made with Continental and home towns approximating in size to the new township.

(v.) Arterial roads should be provided in connection with the Ministry of Transport's road scheme for the eastern area, and also for connecting up with Chadwell Heath Station on the Great Eastern Railway, and with a new jetty to be constructed on the river.

(vi.) Sites to be provided for educational buildings, churches, fire stations, free libraries, police stations, hospitals, infirmary, town hall, coroner's court, mortuaries, cemeteries, public baths, places of amusement, institutes, etc.

(vii.) Provision to be made for shopping centres and markets.

Other important questions, not particularly affecting the design of the Estate, had also to be considered. Amongst these were such questions as water supply and lighting.

The problem of the supply of materials had specially to be faced. The original proposal was to erect 24,000 working-class houses, and it was calculated that about 730,000 tons of building materials would annually be required, or about 2,550 tons per day for the ensuing five years. This enormous amount of material would, it was estimated, involve the use of 600 railway trucks (loaded and empty) per day.

There was, moreover, the great problem of labour, it being calculated that on average 8,000 to 10,000 men per day would be necessary to complete the work within the time specified.

The drainage of the area also presented a complicated and difficult problem. It was originally hoped that the augmentation of existing drains and sewers was all that would be necessary, but experience has shown that an entirely new system will have to be provided and a new outfall constructed.

### B. The Design Itself.

It is a natural tendency to think of Town Planning mainly in a suburban sense, but it is essential, in a case such as this, to deal with the subject from a larger, *i.e.*, from an urban point of view, with due regard to both civic and social requirements.

With regard to æsthetic treatment, it may be stated that the area of land dealt with in this case is practically devoid of natural features, which can be said to influence the site as a whole, or to enhance the beauty of the district. The land is flat, and there are no undulations, important water courses, etc. Such natural features as do exist will be preserved ; even the old hedges and

lanes will be utilised as far as possible where they can be worked into the lay-out, and this has to some extent governed the position of roads.

In the general arrangement a judicious admixture of regular and irregular planning has been adopted. In the scheme as a whole the regular planning will be apparent in the manner in which through communication is obtained, and in the "ring roads." The great roads are straight and direct as far as possible. This regularity is, however, counterbalanced by a greater variety in the general detail of the sections of the town. These in themselves are again treated as smaller units, in which a certain regularity is introduced ; but being varied the one from the other, considerable diversity is secured in the general scheme.

As regards the houses themselves, it is hoped to obtain variety consistent with economy, and to secure that interest will be imparted to the smaller as well as the larger units, and monotony and drab and dreary effects avoided.

The lay-out plan for the whole Estate has been approved by the Council's Housing Committee and submitted to the Ministry of Health. It should, however, be borne in mind that the Ministry have not yet given their approval except as regards the first section of the Estate, upon which building work is already in progress. In fact, the question of making immediate arrangements to proceed with further sections of the scheme is now under consideration between the L.C.C. and the Ministry of Health.

The provision of arterial and main roads, 120 ft. wide, are features of primary importance. The scheme provides for a network of such roads to serve the whole Estate and link up with the existing railway station at Chadwell Heath. These roads would have a total length of approximately ten miles, and the width of 120 ft. would include a central reservation for a double tramway track where necessary.

The course of the Thames is about 5/6ths of a mile south of the Estate, and a corridor strip of land—in which it is proposed in the lay-out plan to construct a 120 ft. road—has also been acquired to form a connection between the southern part of the Estate and the River. A jetty is at present in course of construction on the river side, and will be of immediate use for the transport of building materials and seaborne goods. It is possible that the low-lying land between the Estate and the river will be developed for commercial purposes, and if this should prove to be the case the jetty and approach road thereto will be of great advantage from an industrial point of view.

Two proposed arterial roads, one traversing the northern portion of the Estate from west to east, and the other, a diversion or a widening of the existing Ripple Road (the southern boundary of the Estate), form part of the Ministry of Transport's road scheme for their Eastern Area. Communication from north to south is provided by two main roads ; that on the eastern

side of the Estate runs due south from Becontree Heath, and, after crossing the London, Tilbury and Southend Railway, is diverted to the south-west to connect with the corridor to the river ; the other serves the western side of the Estate between the districts of Ilford and Barking. These main roads form a circuit roughly hexagonal, with extensions in the direction of important existing roads outside the Estate.

Provision has been made in the scheme for a Civic Centre, from which radiate three additional 120 ft. roads, one of which provides direct access from the Civic Centre to the Chadwell Heath Station on the north, and the other two lead in south-easterly and south-westerly directions respectively, to link up with the proposed main roads bordering the Estate on the east and west. The Civic Centre is designed to be an important architectural feature to accommodate administrative and public buildings necessary for a township of the size contemplated. The radiation from it of three main roads, together with the importance of the buildings to be erected there, will impart to the Centre a duly impressive and dignified character.

Immediately south of the proposed site for the Civic Centre and approximately in the centre of the town, is the existing Parsloes Park, which it is proposed to retain and extend to form a public park. Skirting the western side of this park, it is proposed to form a roadway connection between the Civic Centre and a new central station on the London, Tilbury and Southend Railway.

An important feature of the lay-out plan is the reservation along the western and southern sides of the Estate of " open belts " of land, upon which, *inter alia*, facilities will be afforded for outdoor games. A recreation ground of some 30 acres, to meet the needs of the north-eastern portion of the Estate, has been provided by utilising the meadows adjoining an existing manor house.

The necessity for increased railway and traffic facilities has been fully discussed with the Ministry of Transport, and the eventual erection of three additional railway stations, together with a new goods siding on the London, Tilbury and Southend Railway, is under consideration.

A reservation, 150 ft. wide, has been made along most of the arterial and main roads for the erection of shops and other commercial buildings, and areas have also been set apart for industrial purposes on the eastern boundary in close proximity to the railway.

Portions of the Estate have been allocated for the erection of other than State-aided houses. The question of municipal revenue and, therefore, of rateable value, has to be considered quite apart from the necessity of providing residences for other than the working classes in a township where business and industry must play an important part.

The *distribution of land* under the latest scheme would be approximately as follows :—

| | | *Acres.* |
|---|---|---|
| (1) | Working class dwellings (including accommodation roads) ... | 1,000 |
| (2) | Land for leasing for houses for other than working classes (including accommodation roads) ... ... ... ... | 328 |
| (3) | Industrial land ... ... ... ... ... ... ... | 193 |
| (4) | Business land (including 40 acres of railway land) ... ... | 300 |
| (5) | Institutional sites— | |
| | (*a*) Civic Centre ... ... ... ... 25 | |
| | (*b*) Ward Centres ... ... ... ... 24 | |
| | (*c*) Churches (other than those in Civic and Ward Centres) ... ... ... 10 | |
| | (*d*) Schools ... ... ... ... ... 60 | |
| | (*e*) Hospitals ... ... ... ... 30 | |
| | | 149 |
| (6) | Arterial roads (120 ft. wide) ... ... ... ... ... | 149 |
| (7) | Open spaces— | |
| | (*a*) Open belt ... ... ... ... 400 | |
| | (*b*) Park ... ... ... ... ... 115 | |
| | (*c*) Recreation ground ... ... ... 32 | |
| | (*d*) Allotments ... ... ... ... 102 | 649 |
| | Total area... ... ... ... ... | 2,768 |

It is the intention to provide 18,000 working class dwellings. On the land reserved for other than working class dwellings probably over 2,000 houses could be erected. The Civic Centre would afford suitable sites for municipal buildings, important public halls, banks, technical institute and school of art, church, and central post office. The proposed Ward Centres if finally adopted, would be suitable for church and chapel sites, local post offices, and subsidiary public buildings.

C. The Work now in Progress on the First Section of the Estate.

Road and cottage construction has been commenced on the first section of the Estate, and houses as follows have been approved :—

| | | |
|---|---|---|
| 6-room cottages ... ... ... | 144 | 5% |
| 5- ,, ,, ... ... ... | 576 | 20% |
| 4- ,, ,, ... ... ... | 1,155 | 40% |
| 3- ,, ,, ... ... ... | 861 | 30% |
| 2 and 3-room flats ... ... ... | 140 | 5% |
| | 2,876 | 100% |

Of these approximately 678 will be built in brick and 2,198 in concrete.

*Construction.*—The shortage of bricklayers made it necessary to devise systems of building which would reduce bricklaying to a minimum, and at the same time allow the employment of a large amount of unskilled labour. It was early anticipated that concrete construction would play a large part in increasing the number of houses erected. Various forms of construction were investigated, but, in order that the contractors might make an immediate start, orders were issued for work to be commenced on a group of 118 brick houses on existing roads where drainage was already provided. Some cottages are now practically completed, while the others are well advanced.

A geographical survey was made to ascertain to what extent gravel and ballast could be obtained on the site, and a large amount of gravel was found suitable for making a fine quality of concrete either for cottages or for roads.

After careful consideration of the various methods of concrete construction, including block-making machinery and different kinds of shuttering, it was decided to erect a proportion of the cottages on the first section in the following systems :—

*Witan No. 3 System.*—A hollow-wall system, employing blocks made on the Winget pressure machines, enabling cottages designed for brick construction to be carried out in concrete. The external walls of houses are built 11 ins. thick, made up with outer lining $4\frac{3}{8}$ in. gravel concrete, $2\frac{1}{4}$ ins. cavity, and $4\frac{3}{8}$ ins. inner lining of concrete blocks. The cross walls are 9 ins. thick, and the ground floor weight-carrying partitions $4\frac{3}{8}$ ins. thick are constructed of clinker concrete. In this system the external faces of cottages will in some cases be rough-cast and in others plain fair-faced blocks and rock-faced.

*Composite Concrete Construction System.*—This system is a revised form of that originally known as the " Fidler system." The external walls are 9 ins. thick, made up as follows :—Outer leaf, 3 ins., cavity 3 ins., and inner leaf 3 ins., both leaves being constructed of clinker concrete slabs and the cavity between them filled with poured gravel concrete. The external surface being of clinker necessitates the application of rough-cast or similar protection. The weight-carrying partitions on the ground floor are also built of blocks. Special hoop-iron ties 1 in. wide, split at the ends and turned up and down to hold the blocks in position to receive poured concrete, are used in this system. Monolithic bands formed at the first floor and ceiling levels give continuous ties round the building, and provide the bearing for the first floor and ceiling joists.

*Witan No. 1 System.*—Consists in a cavity wall constructed in the following manner :—The thickness of outer slab to external walls is 3 ins., width of cavity 2 ins., thickness of inner leaf 4 ins. Open cavities are provided where floor joists project into the walls, and the adjoining principal wall areas

above and below the floor are formed with closed cavities. The through concrete which closes the cavities will also tie the outer and the inner leaves of the wall together. The outer leaf is treated with a waterproofing compound. The cross walls are of 9 in. clinker concrete, and weight-carrying partitions as before. A rough finish to the external face is obtained by placing fibre matting in the moulds before the concrete is poured, giving the effect of rough-cast.

*Dry Walls System.*—A form of poured concrete construction consisting of an inner leaf 5 ins. thick and an outer leaf 4 ins. thick, the outer leaf being of gravel concrete and the inner of clinker concrete, with a vertical damp course sheeting between the two leaves. Patent climbing shuttering is employed in erection.

These special systems of concrete construction have all received the approval of the Ministry of Health, and the extended use of any of these systems will depend upon experience with economy and rapidity of construction as governing factors.

## Conclusion.

The difficulties which have been experienced are no greater than were anticipated, and have been reduced to a minimum. That they have been so reduced is, I am convinced, due to the fact that the London County Council decided to place the whole of the work in the hands of one "master contractor."

I am of opinion that very substantial advantages accrue from the appointment of one controlling organisation on an estate of this kind. These advantages might be summarised as follows :—

(i.) Final instructions can be given to one contractor solely responsible for carrying them out to the satisfaction of the local authority, and the great difficulties which would be experienced in dealing with a number of contractors are thus avoided.

(ii.) Materials in large quantities can be purchased thus making for economy.

(iii.) The proper distribution of materials is assured.

(iv.) Effective control in regard to entry and distribution of all goods is practicable.

(v.) Labour difficulties are more likely to be reduced to a minimum.

(vi.) More effective recruitment and apportionment of all labour is secured.

(vii.) Dealings with local and county authorities, police, railway, and other officials are simplified.

The appointment of a Master Contractor was in accordance with pre-

cedents created by the Government during the war under conditions of extreme urgency, and in the case of the Becontree Housing Estate it was considered that one controlling influence was just as necessary for the completion of the programme within the time stipulated as it was in the actual military operations during the later and successful period of the war.

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Mr. S. E. BURGESS (Middlesbrough) said at Becontree (London County Council), the main sewers were being put in trenches 2 ft. 6 in. wide with a bottom of good stiff gravel on which was laid 6 or 7 in. of concrete for the full width of the trench. In the provinces such good construction was not permitted by the Ministry of Health in State-aided housing schemes, and, in his opinion, in this case the saddling of the pipes would have been amply sufficient. Also, on secondary roads at Becontree non-slippery manholes, frames and covers were being used, which would cost at least £7 each, but in the provinces such expensive manholes were not allowed. He fully expected that, although the London County Council proposed to build 18,000 houses, that number would be cut down to about 9,000. In Middlesbrough the original scheme, which provided for 3,600 houses, had been cut down to 1,500. They had entered into a contract in January, 1920, for the erection of 418 houses under a contract which provided for the payment of £900 for each house subject to increases in the cost of labour and materials after that date, with the result that it was now found that they would cost £1,038 each, without the cost of land, road-making, etc. At Becontree the estate was being built on a contract which provided for payment of prime cost plus a percentage, and he would like to know the basic price of the houses there ; it seemed to him that under such a system the contractor was out to lose nothing and gain everything. Other houses that are being built at Middlesbrough under the Housing Scheme the final cost was working out at about 20 per cent. above the basic tender price. They also had a hutment scheme for housing 73 families. The cost of the huts (90 ft. by 15 ft.) was £100 each, on which an abatement of one-third was obtained through the Disposals Board, as they were used for housing purposes. These huts were so arranged with extra additions and housed three families each. Including the cost of conversion, the hutment dwellings worked out at about £350 per family. The houses in the provinces were being severely cut down by the Ministry of Health as regards amenities ; were they being similarly cut down in the London area ?

There ought not to be any preferential consideration given to any one district.

PROF. E. R. MATTHEWS (London) pointed out that the L.C.C. regulations made it compulsory that builders and contractors should lay all sewers on a concrete bed regardless of the nature of the ground, and so he assumed that any sewers which that body were laying themselves would be found to be in accordance with their own bye-laws and regulations.

The Ministry of Health, he could assure them, were laying down no hard and fast rule regarding this, but if it could be proved that the ground was

hard and compact the concrete foundation and haunching he thought would not be insisted upon.

He, the speaker, had to design all sewerage and drainage schemes for the Office of Works, and that department had now in hand over 50 Housing Schemes ; what he usually did was as follows :—

> Where the stoneware pipe sewers were only to have a covering of 5 ft. or less, and vehicular traffic was to pass over the surface, the pipes must be laid on a concrete bed, and haunched (and in some cases surrounded with concrete) where they were 10 ft. or more in depth, they must be laid on concrete and haunched owing to the greatness of the pressure of soil, but in other cases (the medium depth in good ground) he saw no reason why concrete should be put in, that is, where the ground was really good, such as compact gravel (dry) or firm clay.

Mr. MAWBEY (Leicester) said one way to cut down the cost of housing is, of course, to cheapen the cost of street construction, but when the Ministry of Health went to the extent of insisting that the 40 ft. roads should be only 13 ft. wide in the carriageways with 12-in foundations, it was impossible easily to get motor vans to the houses, and a satisfactory foundation could not be obtained if it was limited to 12 in. In Leicester they would have nothing to do with cost-plus-profit tenders, because there would be no inducement to the contractor to get on with the work under such a contract. The question of the advisability of using brick or concrete depended on the locality in which the houses were to be built. Leicester was in a brick country, and it was not surprising that although they had invited tenders from firms who specialised in different forms of concrete construction none of them were as cheap as brick. Roads of 120 ft. wide for town-planning schemes was a fine idea, but the question had to be borne in mind as to whether in the future motor omnibuses would cause the disappearance of tramways. If tramways were to continue roads 120 ft. wide were necessary and the cost of upkeep would be considerably reduced if the track with the rails on sleepers were placed in the centre of the road, but if motors were going to take the place of tramways narrower roads would suffice.

Mr. A. J. MARTIN (London), said he thought the best form of contract was that under which the contractor was paid a fixed profit named in competition. In such a contract an estimate of the cost of the work was given, and if it was exceeded the contractor's remuneration was reduced by 10 per cent. of the excess ; while if the work was carried out for less, he was paid 10 per cent. of the saving. In that way the interest of the contractor was enlisted in keeping down the cost of the work.

Mr. H. D. SEARLES-WOOD (London) said there had been a conference between architects, surveyors, and builders to draw up a form of contract for building work that would be acceptable and fair to all concerned, and it was proposed that a tribunal should be set up consisting of an independent chairman appointed by the Government and two assessors (one appointed by architects and one by builders) to decide any disputed points that might arise under the contract drawn up by the committee. Builders often com-

plained of difficulty with regard to contracts drawn up by municipal authorities, which often imposed impossible conditions.

Mr. E. J. STRANGE (Tunbridge Wells) said he agreed with Mr. Searles-Wood with regard to the difficult conditions often imposed by local authorities. It would be of the greatest benefit to the building industry if a common form of contract could be agreed upon for all building work.

Mr. P. H. PALMER (Hastings) said he considered it absolutely necessary that sewers should be laid on concrete, and, in many cases, haunched with concrete. Where possible, he also covered them with concrete. He found that sewers laid without concrete were smashed after a few years. He was supervising the erection of houses by direct labour, and, with the assistance of the trade unions, had managed to get a reasonable output ; at present the bricklayers were laying the equivalent of 750 bricks per eight-hour day. His men were also working amicably with ex-Service men, of whom he had had a considerable number trained.

## Communal Heating and Hot Water Supply.

By John A. Macintyre, B.Sc., M.Inst.C.E.

(Précis.)

THE paper deals in a general way with central-station heating, pointing out that there are already large installations in this country in which large factories covering wide areas are warmed and supplied with hot water from a central source.

There is no difficulty in the design of an installation which would be suitable for large communities of dwelling-houses, but it is pointed out that the cost of installing the outside mains and the losses in these outside mains make the system very expensive.

The author suggests as an alternative to the usual design of garden cities the building of large blocks of flats containing hundreds of dwellings in the open country surrounded by land over which the residents have communal or individual rights. Such blocks of residences could be warmed quite economically from a central source, and the residents could enjoy other communal advantages such as a central dining-room, gymnasium, laundry, etc.

It is pointed out that hot water pipes and radiators warm the air of a room, but do not warm the individual by radiant heat, and in this respect open fire heating is much better.

It is suggested, therefore, that where warming by radiators is adopted, the air in the room should be tempered only by such means, and that supplementary heating should be provided by gas fires.

The design of central stations is discussed, and the advantages of combining gas, electricity and heat generating stations are pointed out. The central-station engineer is advised to survey the area which his station supplies with a view to obtaining as much heat load as possible, but he should not deal with this necessarily either by gas or electricity. In many areas where large quantities of heat are wanted it is suggested that substations may be put down from which heat is supplied to the vicinity direct and electricity generated and fed into the network from the main station.

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Mr. Kaye Parry said the question of central heating for garden cities was worthy of serious consideration. An experiment was being tried at a garden suburb near Lincoln where the waste steam at the electricity works was being used to supply hot water and heating to the houses. The inclusive charge for electric light, hot water, and heating would work out at about 5s. per week per house. Not only would the householders be better off, but the economy in fuel consumption—a very important matter just now—was remarkable.

Mrs. STEWART, J.P. (Darlington) remarked that electric lighting and heating was welcomed for its cleanliness and smokelessness, but that she had found from experience that electric heat was not sufficient for cooking.

Mr. SHENTON (London) was not in agreement with the author as to psychological effects of open fires and of radiators. If a building were properly heated the fires were not missed on a winter's day any more than they were missed on a day in warm weather. Heating work in living houses was generally ill-designed, and hence a bad impression was produced.

There were psychological effects produced by smoking chimneys and at times, when the fire was not burning well, which were not produced by radiators. He also asked the author to explain why he contended that a heating main in a road must be run in a bricked trench, which had to be drained. There appeared to be no reason why such a pipe should not be buried if properly insulated.

Mr. D. PUGH-JONES (Cardiff) was of the opinion that nothing could compare with electric heating ; it was always handy, simple, clean and efficient, and meant a great saving in the cost of labour.

Central heating was very good, but initial cost was rather high, and it had to be kept going all the time, but it eliminated a good deal of the smoke nuisance as compared with open fires.

Gas appeared unsatisfactory, particularly in bedrooms without flues.

Mr. FINCH (City of London) said, for an ordinary cottage housing scheme for 2,000 houses central heating and ordinary domestic hot water supply worked out at 6s. per house per week, which he considered very excessive and not within the limit of practicability.

Mrs. CLOUDESLEY BRERETON (London) said the difficulty encountered when hot water was "on tap" was that a great deal of it was wasted ; the fact that the service would be paid for at a fixed sum, probably added to the rent, would mean that there would be no inducement towards economy. Perhaps the problem could be solved if a meter were fitted that would measure both the amount used and the heat at which it was supplied. The modern method of laying out estates would add to the cost of such services, as much longer transmission lines would be necessary, with consequent larger transmission losses.

Mr. J. A. MACINTYRE, in reply, said that with the present price of coal he did not think it possible to supply electric lighting, cooking, hot water service and central heating at 5s. per house per week.

Cooking by electricity should not take a long time, and the difficulties experienced by Mrs. Stewart were probably due to the fact that the plant was in too small units. From an economic point of view electricity companies have a tendency to instal small units, which, of course, take less current than large, but at the same time take longer to cook the food.

## The Utilization of Sewage Sludge.

By JOHN D. WATSON, M.Inst.C.E., Engineer to the Birmingham, Tame and Rea District Drainage Board (Fellow).

THE statutory duty of a Local Authority is to get rid of sewage sludge at the least possible expense without creating a nuisance. If it is possible to utilize sludge profitably, then that also is a duty; but it is a duty for the most part which remains unfulfilled.

As the result of research and practical demonstration, we are now able to point to various attainments, *e.g.* :—

(1) Cases where grease has been eliminated and made marketable.
(2) Cases where it has been used as manure, and where it has been sold as an organic base for a fertilizer.
(3) Cases where activated sludge has been used as a fertilizer.
(4) Cases where the gas liberated from sludge has been used to generate power.
(5) Cases where it has been employed as an auxiliary fuel for steam raising.
(6) Other less well known instances of the recovery of valuable ingredients from sludge.

(1) *Grease elimination.*—No two sewages are precisely the same, so that economy can result only when careful consideration is given to all the factors of the case; for instance, it cannot be assumed because Bradford can recover grease profitably that Birmingham can do so too. In every instance the present and prospective grease content in sewage, and the character of the trade, are the governing factors in determining whether grease recovery is likely to be a profitable undertaking or not. The grease contents of the sludge at Bradford and Birmingham, calculated on a perfectly dry basis, are respectively 40 and 17 per cent., and those figures are likely to remain reasonably accurate so long as the present industries remain dominant in the respective towns.

As a guide, it may be assumed that when a sludge, after acidification, contains 15 per cent. of grease, it can be recovered profitably, provided the marketable price of grease is not less than £15 per ton, and that a daily supply of 100 tons of wet sludge are available with which to carry on a regular recovery business on commercial lines.

Bradford, Huddersfield and Morley, towns engaged in the woollen and textile industries, all have plants for the extraction of grease, and all show profitable returns. The methods of extraction vary, depending largely on the amount of grease recoverable. At Huddersfield the sludge is pressed

cold after acidification; the resulting cake, containing the full grease content of the wet sludge, is afterwards dried and de-greased in a solvent extraction plant; the grease is reduced from 30 down to 3 per cent. on a perfectly dry basis, and the sludge is left with 3·5 per cent. of nitrogen available as manure. Birmingham, the centre of the brass and non-ferrous metal industries, is one of the least likely places to look to for an example of recovery of grease, seeing that the sewage contains large quantities of waste acids, sulpho-cyanides, pickling liquors and brewery waste, as well as domestic refuse; yet an experimental plant has been installed there which bids fair to show that a product, which is a mixture of fatty matter and mineral oils, can be obtained to command a price which will enable the work to be done without loss, and at the same time improve the residue as a fertilizer.

A big step will have been taken towards rendering sludge more popular as a fertilizer if grease is first eliminated. In this respect the Huddersfield process affords a good practical example of what can be done to recover grease; it breaks up the soapy matters and sets them free in the form of fatty acids; at the same time it conserves the nitrogenous matter for use in the production of a fertilizer. This acid process precipitates and fixes in the sludge far more nitrogenous matter than is obtained by the employment of simple sedimentation, or by the addition of milk of lime. When the grease content is over 20 per cent., it will probably be found economical to adopt the acid precipitation process: but, on the other hand, it will probably be found too costly if the sludge has a low grease content. This is clearly a case for the guidance of the specialist.

(2) *Manure and fertilizer.*—Sludge has undoubtedly a manurial value which we cannot afford to ignore in these days when horse manure is rapidly disappearing and frozen meat is taking the place of home bred cattle.

The average composition of sludge dried at 100° C., calculated from the analysis of 191 samples from six different towns (Fifth Report of the Royal Commission), is as follows:—

| | *Sewage Sludge.* | *Farmyard Manure.* |
|---|---|---|
| Nitrogen ... ... ... ... | 1·83 | 2·66 |
| Phosphoric Acid ... ... | 1·34 | 0·96 |
| Potash ... ... ... ... | 0·15 | 1·33 |

The analysis of farmyard manure, taken from Thorpe's Dictionary of Applied Chemistry, is placed in juxtaposition for comparison. Manure is always superior to sludge; its composition is less stable, and the nitrogen and phosphate more easily available, the potash in the sludge moreover is almost negligible.

The preparation of a fertilizer from sewage sludge has not been uniformly successful. Its merits are not known to the agricultural community, its grease content and its bulk, not to speak of its heavy transportation costs, compare unfavourably with the other manures of like fertilizing value already on the market.

Unfortunately the efforts which have been made in the past to induce investors to support schemes to utilize this class of fertilizer have met with only partial success; the problem is an economic one, and instances like the production of Globe Fertilizer at Glasgow, Manurito at Dublin, and Native Guano by the A.B.C. process at Kingston-on-Thames, have left unmoved the man whose first consideration is a 10 per cent. dividend.

So long as the farmer can get sufficient manure to serve his purpose for less than it costs in the aggregate to buy, transport and handle sludge, so long will he fail to buy it, and so long will the investor turn a deaf ear to those who, like the German chemist, Liebig, and the late Sir William Crookes, urge the need to conserve the rapidly diminishing supplies of manure.

Those who are interested in the utilization of sewage sludge as a fertilizer should direct their attention to the following phases of the subject :— (1) obtaining it from the sedimentation tanks before it enters the putrefactive stage; (2) elimination of as much grease as possible; (3) elimination of as much moisture as possible; (4) appraise it at its true value, instead of trying to attach a value to it which repeated use will not bear out.

(3) *Activated sludge as fertilizer.*—Scientific research and practical demonstrations at Manchester, Worcester, Sheffield, Birmingham, etc., go to prove that the process of sewage purification initiated by Dr. Fowler, which has become known by the unattractive name of " Activated Sludge," not only entails no loss of nitrogen, but, unlike most other processes, produces sludge with a nitrogen content equal to twice that obtained from sludge taken from an ordinary sedimentation tank, whilst the potash is ten times as much, and the phosphates similar. If this sludge could be dried and made available as a fertilizer—and under certain conditions it can—the problem of efficient hygienic disposal of sewage would not be far from solution; but so far no one has succeeded in freeing activated sludge from water to such a degree that it has become available for manure, and made portable enough to be applied to arable land. The growing knowledge of colloids makes one sanguine that research will be rewarded, and that the nitrogen, which is generally as high as 5 per cent., will ultimately be utilized and made available as a fertilizer; but, so far, the difficulties have not been overcome.

The author does not take a pessimistic view of the difficulty of de-watering this sludge, but he regards de-watering as an essential feature of the process if it is to become a marketable fertilizer, and he cannot forget the very great difficulties he has had with what has become known as humus, which in its fresh state is practically identical with activated sludge.

Many experiments have been made at Birmingham to get rid of this humus, and none of them have been successful ; they included an endeavour to filter it through a sand filter built like an ordinary waterworks filter ; turning it into long deep trenches and covering it over with dried grass to keep down smell ; lagooning it in shallow square plots of gravelly soil ; irrigating grass meadows with it ; centrifuging it ; pumping it back into the silt tanks through which the sewage passes before it is sprayed over the bacteria beds ; but they all failed. The solids and the water emulsify so completely that humus is still like a jelly after lying in shallow lagoons for ten years.

(4) *Power from sewage gas.*—This idea is by no means new, but knowledge of recent successes comes from Australia, where several plants producing power gas of good quality from septic sludge are in operation. In a word, the process consists of blowing oxygen, as atmospheric air, through septic sewage, which is in an active state of fermentation, and utilizing the gas liberated to form an explosive gas. Analyses show the septic tank gas to be composed of :—

| | | | | | |
|---|---|---|---|---|---|
| $CO_2$ | ... | ... | 14·0 | per cent. | by volume. |
| O | ... | ... | 1·1 | ,, | ,, |
| $CH_4$ | ... | ... | 60·0 | ,, | ,, |
| H | ... | ... | 8·0 | ,, | ,, |
| N | ... | ... | 16·9 | ,, | ,, |
| | | | 100·0 | ,, | ,, |

The engine is said to run on a mixture of gas air in the proportion of 1 : 6, consuming about 20 cubic feet of gas per brake-horse power-hour, and can apparently be kept so free from carbon deposit as to imply a clean gas as well as good combustion. Unless in warm climates, it is beneficial to heat the sewage, and some of the gas liberated is used for this purpose. It is hoped, at Birmingham, where a small experimental plant is being installed, to produce good results without air blowing or heating beyond utilizing all waste heat from the engine. The exhaust gases from the engine are passed through the sludge in two 9-inch cast iron pipes, fitted as expansion boxes on the 3-inch exhaust pipes, and the cooling water from the water jacketing of the engine is stored under the tanks, and only separated from the sludge by cast iron plates. Whether it will prove a

commercial success to derive latent power from this source remains to be seen, but in these days when national economy is inculcated on all hands, it would be wrong to refrain from probing a possible scheme to the bottom.

(5) *Fuel for steam raising.*—During the coal strike of 1912, and again towards the end of the recent strike, Birmingham sludge—which is prepared by a biological process and subsequently air-dried—was employed to augment the coal slack used in Lancashire boilers. By the Birmingham process (differing only slightly from Travis's hydrolytic tank process—which, in turn, was subsequently adopted and patented in Germany as the Imhoff tank process) 300,000 tons of liquid sludge were air-dried in 1914 at a cost which, before the war, was comparable with the cost of sending it out to sea in specially constructed boats, as is done in London, Glasgow and Manchester. In 1914 the cost at Birmingham was 5·7 pence per ton, and the average cost for the years 1914-21 was 10·8 pence per ton.

The Birmingham tests go to show that 1 lb. of air-dried sludge will evaporate at least 1 lb. of water. Mr. Sylvester, chemist, who tested for calorific value, found a sample, dried at 212° Fah., to give a calorific value of 4,893 B.T.U. This was confirmed by Dr. W. B. Davidson, who found a sample dried to the same temperature to yield a calorific value of 4,120 B.T.U. The Refuse Disposal Committee of the City tested it on the Nechells Destructor at various times, so did the Horsfall Destructor Co., and the Electric Supply Department of the Borough of Sutton Coldfield, with varying results; but all the results show that when the material is burnt on suitable fire grates, and in appropriate quantities, it is a valuable aid when coal slack is scarce. It should be stated, however, that there is considerable ash, and that there is a tendency for it to flux and adhere to the furnace bars, effects which tend to minimise its economical value.

The calorific value of sludge must vary, but the variation is not marked, and Birmingham sludge may safely be taken at 2,200 B.T.U., or about one-fifth the value of ordinary Midland slack. It is obvious that high transportation charges would be fatal to its economical use. Unless, therefore, there is a reasonable prospect of sludge being employed in the immediate vicinity of the drying beds, the cost of such a scheme might be prohibitive, but where there are means of using sludge in the immediate vicinity of the drying locality for steam raising and electric power generation, it should be highly remunerative. With these facts in mind, the Chairman of the Birmingham Drainage Board authorised the engineer to prepare a scheme to generate electric current by utilizing sludge which is now unproductive.

(6) *Various.*—It is interesting to recall that Birmingham was advised about fifteen years ago to put down a plant to recover copper from sewage. The analyst not only found measurable quantities of copper, but traces

of gold and silver. The plant never materialised, because almost immediately the copper ceased to come down the sewers. Manufacturers realised, when public reference was made to the subject, that it would be easier for them to recover copper from a small volume of liquid in their own works than it would be for the local authority to recover it from a large volume.

The object of those engaged in salvage of waste products may be attained in more than one way, and this experience of the failure to recover copper from a great outfall sewer is not necessarily less profitable to the community because the manufacturer took care to render its salvage unnecessary.

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Mr. A. J. MARTIN (London). Waste is one of our great national sins, and nowhere is it more conspicuous than in our dealings with sewage and sludge. Mr. Watson has pointed out several ways in which sludge may be utilised, and his experience described under the heading (6) "Various" is most suggestive.

He (Mr. Martin) was dubious as to the desirability of dewatering sludge. The proper destination of sludge was the land, and it could, as a rule, be delivered to the land more economically through pipes in a wet state than by drying it. The output of a large works should not, of course, be concentrated on too small an area. Mr. Clifford had shown at Wolverhampton what could be done in the way of piping sludge to the surrounding farms. It was true that there were periods when certain crops could not utilise sludge, but that was no reason why it should not be delivered to the land whenever the latter could deal with it.

Mr. MAWBEY (Leicester). The best way to deal with sewage sludge is to pump it through 4 in. to 6 in. or 9 in. mains on to suitable land where at all convenient and practicable. At Leicester, for about 15 years past, all the sludge from the tanks, prior to bacterial and land treatment, has been so pumped on to prepared arable land, ploughed in when dry, and then cropped, years ago he advised that this system, when it became necessary, be extended to surrounding farms even to two or three miles away. That this method, where practicable, might probably solve the difficulty of dealing with the sludge from the activated system of treatment. The effluent water draining from such sludged areas would, however, have to be treated on land, or otherwise, to prevent pollution of watercourses.

Mr. G. W. LACEY (Oswestry). With regard to pumping sewage sludge on to land for some months of the year it would be highly valuable from a manurial point of view if a sufficient area of land could be made available. He doubted, however, if it was a practical proposition, because it could not be distributed over growing crops and there must necessarily be periods when distribution on to land direct would be impossible. Further, the cost of laying a network of distributing mains and providing power plant (for gravitation could not be depended upon in the majority of cases) and the obtaining of wayleaves made it seem to him, from a financial standpoint, quite hopeless. If the activated sludge process was to be the com-

plete success which it was hoped, and for which there were good grounds for belief, then research work into the best method of de-watering the sludge would have to be carried out in order to overcome the difficulty; and in view of past achievements, he did not think the problem was beyond solution.

Mr. D. Balfour (Newcastle-on-Tyne). The disposal of sludge as suggested by Mr. Watson, applies to very large towns, the number of which are small as compared with the number of towns of 50,000 population and downward. In my experience where land of an open character is available, the cheapest and simplest method is to spread the sludge over and plough it into the same. In many cases I have had trenches 3 to 4 feet deep excavated, and when filled with sludge for two-thirds their depth, the excavated material has then been spread over same, slightly raising the land. This method causes little or no nuisance, and the land is available for re-use in a few years.

Mr. Shenton (London) suggested that with regard to activated sludge the objection that it could not be applied to land all the year round might be met by the method of drying the material during those months of the year when the crops were growing and conveying it to the land through pipes during those months when the land required it. In the dry months of summer, when crops were growing, sludge could be more easily dried by evaporation in shallow, filter lagoons than in the wet winter months, when it was needed on the land. Here was an advantage. The dried sludge could be used or sold. The cost of conveyance of liquid sludge through pipes should not be great. Activated sludge contained 99 per cent. of water, and could be easily pumped or made to gravitate under suitable conditions. Even the pipe lines need not be expensive. Reinforced concrete Hume pipes were cheaper that cast-iron and quite suitable, and for gravitation mains stoneware pipes could be used.

Mr. W. C. Tyndale (London). It was to be remembered that sludge from different processes varied very much in its nature from that which was half digested, very offensive, and difficult to deal with, to that which was more in the nature of humus. It was desirable to produce sludge in as earthy condition as possible, when it was comparatively easy to deal with. One of the ways to deal with it was to run it on to ash beds when it would quickly dry out and could be removed in a spadeable condition.

Mr. J. D. Watson in reply said very much depended on the circumstances of the case, but it might be assumed that no installation was complete without a recognised means of sludge disposal which was available in all weathers. The English climate was so variable that the farmer was not to be blamed for declining to have anything to do with liquid sludge at certain seasons of the year. Birmingham had a large farm under the management of the Drainage Board, and the Board owned about a dozen farms which were cultivated by tenants, yet the system of pumping crude sludge on to land had been found to be unsound, both from a hygienic and an economical point of view. What he had described applied to very large towns, but it might apply to small ones too if means of pumping was available. He had used the Hume concrete pipe, and could speak well of them when pressure was not excessive.

## The Design of Hospitals.

By Edwin T. Hall, F.R.I.B.A. (Fellow).

GENERAL HOSPITALS properly belong to towns, to dense populations, and so must be in or near to the large aggregations of individuals whom they serve, both for the convenience of patients and for ready accessibility by the honorary Medical Staff practising in the town, so as to secure the attendance of the highest talent and experience. Sites should be surrounded by roads or other channels for wind currents, should be as elevated as possible, and where a suburban site is obtainable, it should be of such an area that the buildings may be well set back from the boundaries leaving an open zone of land, with trees and other park-like features, all of which are of value in their psychological effect on patients. Wards on the pavilion system are best, and these should be well separated by open spaces for wind currents and sunlight. If this be attended to we need pay little attention to the dicta regarding the number of beds per acre as there is no data to justify the arbitrary figures that have been laid down from time to time. Again, the limitation of the size of a hospital has been laid down by various experts, but, given well designed buildings and a properly organised staff, there need be no hard and fast rule. In the late War, the King George's Hospital in London designed by me, contained 2,400 patients' beds.

Where site permits, the axis of a ward should preferably be north and south with windows east, south and west, by which means the sun from rising to setting shines upon every window and wall.

Main wards most generally contain from 18 to 24 beds, but there should be attached one single or two-bed ward, and of course the accessories of Ward Kitchen, Sanitary Annexes, Stores for linen, patients' clothes, etc.

Of the area and cubic space per bed much has been written and said. The late War has demonstrated that the old standards are in excess of what is absolutely necessary, and that the standard of the Ministry of Health for Poor Law Infirmaries is sufficient as a minimum for curative treatment, but I think 8 feet wall space should be given to a bed and about 100 superficial feet.

Where there is a Medical School a larger area is required to enable students to congregate near a case and a 9 feet to 10 feet wall space is usually allowed, with a floor area of 117 to 135 feet.

In addition to the broad divisions of Medical and Surgical Wards, there should be special wards for diseases of women and of children, for eye,

ears and nose cases, and in manufacturing districts for burns, and ample accommodation for casualties.

The disposition of Operating Theatres is one on which Surgeons differ. In some large hospitals, theatres are all concentrated with their accessory rooms in one block; in others, as at Manchester, the wards are grouped in units, each under a Senior Surgeon, with its detached self-contained operating suite consisting of seven rooms.

There should be an Isolation block for suspected cases of infection.

The Out-patients' department is of great and growing importance. It should be detached, but with convenient access to the main buildings, for ready transference of patients. This should contain, in addition to Medical and Surgical Consulting rooms with their dressing and examination rooms, rooms for Dentists and Oculists, for Child Welfare work, for Maternity, for Lectures to women on home hygiene and for the Almoner.

Except in very large hospitals, the Dispensary should be arranged so that it may serve the in-patients as well.

The treatment of Venereal diseases both for in and out-patients should be in a separate building near the in-patients wards, for it is found in practice that visitors to patients are shy of going to these venereal wards if they are conspicuously set apart from the rest of the buildings.

X-ray work has so developed that provision must be made for this, and where one centre is alone justified, this should be conveniently placed both for in and out-patients. In a large hospital, electrical treatment on an extensive scale should be provided for. Medical baths are again of growing use, and in the late War were in extensive request. Another desirable feature in an ideal hospital is the Surgical Therapeutic room or Gymnasium, and one of the best I know is that at Nuremburg.

A Laundry with patients' and staff sides should be provided, as well as a disinfector for bedding and clothes, and a destructor for dust. Workshops, Boiler and Engine House, should give accommodation where necessary for the generation of electricity, for central calorifiers, both for heating and hot water supplies, whence all buildings may be served.

The Mortuary building with its Post-Mortem room and Mortuary Chapel, should be so placed that hearses shall not be seen by the patients. There should be a cold storage room for corpses, and refrigerated larder for meat and milk.

In hospitals with Medical Schools and Hostels many other departments are required, but the details of these are outside the scope of this lecture.

In every hospital a Chapel for Divine Service should be provided. The commendable zeal for the physical treatment and cure of disease has obscured in late years the consideration of the spiritual side of Man's nature, and as

the state of a man's soul and mind largely affect his powers of recuperation and desire for life, the Doctor, the Nurse and the Chaplain, who are also psychologists have greater influence than those lacking the spiritual insight which can diagnose and comfort a mind diseased and perhaps raise the patient to a higher plane.

Lighting should be by electricity, heating generally by hot water (with an open fire in each ward for cheerfulness), but in the Operating Theatres by steam so as quickly to raise temperature.

Ventilation should be by fresh air passing over the radiators so as to change the atmosphere of a ward continuously to the extent of at least three times an hour.

Corridors between pavilions, I think, should be open at the side for through aëration. In Germany, they have generally, no covered ways at all, which I think is wrong.

There should be separate homes for the Nursing and Domestic staffs, male and female. Their dining rooms should be grouped near the general hospital kitchen, but otherwise the homes should be so placed that when the staff is off duty there may be pleasant prospects for all. Recreation courts for tennis, etc., should be provided. The resident medical staff may be housed in the administration building, which, with its offices, Board and Committee rooms, should be readily accessible to the public.

### SCARLET FEVER AND DIPHTHERIA.

The number of cases treated in these hospitals is so great that reference should be made to them.

The general principles governing all hospitals apply to these, but for infectious diseases more isolation from the community is necessary. The Ministry of Health require a zone 40 feet wide between the boundaries of the site and the patients' buildings in all scarlet fever and diphtheria cases, but a wider one is better. In small pox, a zone of $\frac{1}{4}$ mile is required, and this from all the evidence obtained is desirable. There should be entire separation of wards for scarlet fever from those for diphtheria and neither of these should be in the same curtilage as small pox wards. In these hospitals, there should be Isolation Pavilions to provide accommodation for nearly 10 per cent. of the total patients so that other and alien infectious diseases may be segregated. At Nottingham, under its distinguished Medical Officer. Dr. Boobbyer, infectious cases are successfully treated in the open air in verandahs.

There should be receiving rooms for examination of patients. The area per bed should be greater, and the number of diphtheria patients in one ward should be less than in a general hospital, as more nursing is required.

One theatre suite is sufficient for each hospital.

Provision should be made for the destruction of badly infected articles, and for the sterilization of sewage.

### Sanatoria and Hospitals for Consumption.

Probably more interest is to-day focussed on this subject than on the others I have dealt with.

The Sanatorium, stated shortly, is the embodiment of the root idea of open air treatment under medical supervision. It is a residential school of hygiene, where patients in the early stages of tubercular infection are taught primarily to take the fullest advantages of open air and sunlight, and to regulate their lives as to hours of rising, eating, resting, working and sleeping ; that disease may be arrested and eradicated ; that vitality may be stimulated ; that energy may be renewed ; that the subject may come out a healthy, stronger, and better citizen, and when he comes out that he may exercise the influence of his first-hand knowledge and disseminate the lessons he has learned.

The first sanatorium was erected in 1854, at Gorbersdorf, in Silesia, but in 1884 Germany passed the Sickness Insurance Act, and in 1891 the Invalidity Insurance Act, and between 1896 and 1904 no less than 45 sanatoria were founded in Germany, with a total of 6,500 beds. In England and Wales up to 1907, there were 63 public and 30 private sanatoria, with a total of 3,987 beds.

The *German sanatoria* are based in the barrack type, many are of three, four and five storeys, and, as a type, are to be avoided.

In 1911 the National Insurance Act was passed and, but for the war, great additions would have been made ere now to the totals last given.

I was entrusted with the first large sanatorium erected under these new conditions, that for the King Edward Memorial Association at Pontywal, in Breconshire, for 304 beds. It is of entirely novel construction, permanent in character, without sunk foundations. Its contract price before the war, including all engineering, boilers, electric generating plant, accumulators, laundry machinery, kitchen plant, heating, lighting, etc., was about £175 per bed. The ground sloping rather steeply towards the south, and practically level across, dictated the most economical block plan. There are 10 parallel one storeyed pavilions looking over one another for ambulant cases. The larger ones contain 26 patients. Every patient has a separate room opening on to a terrace. The children's wards contain four beds each, all inter-communicating. There is an isolation pavilion divided into separate rooms with glazed partitions for better supervision. The hospital block is of two storeys for bed cases, and each patient has generally a separate ward, but there are two wards of four beds on each floor.

The nurses are located to the south of all, where they may be quiet.

The male servants are in the power station block, which encloses a quadrangle, from which the boiler and engine house, the accumulator house, the laundry, the disinfector, the mortuary, the laboratory, and the stores for steam and house coal all open.

The Medical Superintendent has a house, and the assistants are located in the administration block, which is in the centre of all.

The dining and kitchen block, with the stores, is also central. Writing rooms adjoin the patients' dining hall.

There is a separate recreation hall and billiard room for patients, the former being fitted for cinematographic displays.

There are four cottages for married employees, and a chapel is about to be erected.

Among other modern public sanatoria may be mentioned that for the county of Kent, at Lenham, with 125 beds ; the Highdown Sanatorium for London patients, at Godalming, with 238 beds ; the Copthorne Sanatorium, at East Grinstead, for London patients, with 300 beds. Among private ones are the Frimley Sanatorium for 150 patients ; King Edward VII. Sanatorium, at Midhurst, for 100 patients ; the Northwood Sanatorium, for 114 ; the Crossley, in Cheshire, for 90 ; and the Winsley, near Bradford-on-Avon, for 60 patients.

The subject was amplified in a lecture illustrated by 60 lantern slides, showing all kinds of hospitals which were individually described in detail.

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Mr. WILLIS (Chiswick) thought the principle adopted in this country of building hospitals for consumptives with only one or two storeys was much better than the Continental method of erecting such buildings in tall blocks. The latest method of constructing reinforced concrete walls had reduced the cost of erecting one-storey buildings, and, by eliminating the foundation except for a concrete raft, one-storey buildings with the same accommodation could often be erected at even lower cost than high buildings. The design of institutional buildings was gradually being revolutionised, and he thought if local authorities had the opportunity of reconsidering the design of schools they would not now be built in tall blocks. In the design of hospitals for consumptives, he also thought the one-storey building the best. On the Continent it was often the practice to place the w.c.'s, etc., adjoining the walls of the wards, but in this country a cross-ventilated corridor was always provided between the wards and the offices ; this practice was essential.

Sir HERBERT COHEN (Governor of St. Bartholomew's Hospital) said the psychological aspect of the effect of the mind on the body had to be seriously considered in hospital design, and every effort should be made to obtain a homely appearance in the wards.

It was essential that medical students should receive instruction in hospitals, but it was not necessary to make a hospital with a medical school more expensive than one without by the provision of more wall space per bed. Everyone had the benefit of doctors and should do all they could to assist in medical education by becoming " clinical material " when in hospital, but there was a corresponding duty on the part of the hospital to see that too many students did not go round to the patients. The attendance of many students was worrying to the patient, and eight feet of wall space per bed would allow of sufficient students to congregate around a patient without worrying him ; with ten feet of wall space the number that could stand around the patient would be worrying It would be desirable for each hospital to have its own laundry, but was it necessary that it should be on the premises ? The laundry, while being part of the hospital for administrative purposes, need not be on the same site in districts where land was expensive. The suggestion that tuberculous cases should be accommodated on the roof of the hospital was valuable.

Dr. Bertram Hill (Selby) said that the treatment of Tuberculous cases on the roof was fairly common in hospitals on the Continent, in Brussels for instance.

For roof treatment one must be guided entirely by the situation of the hospital, as in crowded centres the atmosphere would not be pure enough.

In Leeds this treatment was tried on a small scale by having an open corridor.

Mr. Edwin T. Hall, in reply, said in suburban districts it was desirable to have a Laundry in the hospital site, but it was not desirable in the heart of a city. The laundry should not be in the hospital building.

Hoppers to ward windows were very important, but they should always be closed at the sides. The framing of the enclosure should be made so that the sashes would come right down for cleaning the outside.

*Casements or Sashes.*—For Sanatoria, casements were best, and all should be made to open. With sashes one could not get more than half the area of the window open. For hospitals he generally had sashes, but in some cases had put a series of Hoppers, all the air being thrown up.

He was not aware that in Brussels they treated tuberculous patients on the roof. As he had explained, they did so at the Camberwell Infirmary in conjunction with specially designed wards. If there were a fog you could not put your patients outside.

## "Rural Housing."

By Miss C. Cochrane (Member).

(Abstract.)

IT is a grateful sight to travellers throughout the country to see everywhere the large numbers of cottages which have been built during the last two years. But more are still wanted in many districts, and it is earnestly to be hoped that effort will not be relaxed until the demand has been met, and also cottages unfit to live in have been replaced by others. The urgent need for economy at the present time, if the nation is not to become bankrupt, necessitates the need for the greatest care in the building of the cottages, provided that a sufficiency of space is never sacrificed. There is no doubt that in many instances unduly large profits have been made by builders and contractors. Local authorities should refuse to build at such prices as £900 and £1,000 a cottage. In the rural district where I live, in Cambs., my Council have not paid more than £1,350 for any pair of cottages in their district, and where it is close to a station the price is £1,180. The Council refuses to pay more, and I may say the cottages are well built, with living room 18 ft. by 12 ft., scullery 18 ft. by 11 ft., a good-sized larder, and an outhouse adjoining the main building 12 ft. by 7 ft. There are three bedrooms, the smallest of which holds a double bed. The cottages are of brick and slate, and each is provided with a quarter of an acre of garden ground.

In places where a water supply is impossible the Ministry will recognise the proper storage of rain water.

Councils might do more than is done at present by buying old cottages which, from disrepair, etc., are unfit for occupation, and by spending, say, £200, on restoring and adding what is necessary, they could let such cottages at a rent which would be economic or nearly so. Such cottages can often be bought for about £20 from little men who cannot afford to repair. This aspect of the Housing question has not received the attention it deserves.

A few months ago the Ministry of Health entirely changed its views in regard to the non-parlour house. Before this they raised the strongest objection to the scullery being anything larger than a place where it would be impossible for the family to live in. The Housing Commissioner, at the time my Council's plans were presented, took great exception to the size of the scullery, and it was only owing to our very determined attitude that he gave way. He had ruled out the parlour, and we therefore considered that the scullery must be of a size for the family to take their meals in if they desired, and this enables the living room to serve also the purpose of a parlour. A few months ago plans of this kind were brought out by the Ministry

itself, who said it had been forcibly brought to their notice that there was a considerable demand for this type of cottage. I have also been glad to see that in many of the more recent plans the size of the third bedroom has been increased. The size of this room in the original plans was ridiculously small, holding only a single bed, and therefore perfectly useless where there is a large family of boys and girls. No rural Council ought to consent to the provision of rooms of such a size. The barn or outhouse is another necessity in a rural district, and all Rural District Councils ought to insist on these where the imagination of the Housing Commissioner does not extend as far as the country. With a quarter of an acre of garden, wheelbarrow and tools are needed, also storage for poultry food, straw for pigs, wood, bicycles, etc., etc. I have seen wheat stored in the parlour and onions under the bed because there was no other place to keep them in.

Drains are not required where there is a quarter of an acre of garden, as the contents of the E.C. can be disposed of here to the enrichment and improvement of the soil. They can be dug into the ground in trenches about 4 inches deep. The slop water can either be taken to a small concreted tank in the garden and used for watering the plants, or it can be led from a pipe leading from the sink to the outside into a half-trench pipe laid loosely and conducted a little way down the garden, and currant and gooseberry bushes can be planted at the sides.

A steamless copper was a great boon.

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Mr. Robinson (Durham C.C.) congratulated the Author on the fact that she had provided steam escape pipes in connection with the set-pots, or coppers, and by so doing had set an example to many responsible for housing schemes where such necessary adjuncts were often absent. He also showed that the deplorable conditions revealed in a recent inspection by him of over 20 urban districts, and the present terrible cost of repairs, had impressed him with the hopelessness of proceeding to seek a remedy on the present uneconomic lines, and that he had come to the conclusion that generally speaking, little or no real progress either with new houses or carrying out necessary repairs to old ones can be made till we get down to something like pre-war costs, and that, in his opinion, to bring this about the Government should apply itself diligently to the cheapening of the necessaries of life, and the materials necessary for the proper housing of the community.

Miss Churton (London) said that last year, through the instrumentality of the Rural Housing Association, an old cottage in Norfolk was renovated and remodelled at a cost of slightly under £400. The cottage had stood empty for fifty years owing to its dilapidated condition. Now it was a good four bed-roomed cottage, considered the best in the village.

If work of this kind were more generally taken up, both by Local Authorities and private enterprise, it would do much towards improving the housing conditions in our villages.

Dr. BERTRAM HILL (Selby). The demand for houses in Rural Districts is rather to replace bad property than to house increasing population. The farm labourer is quite unable to pay the high rent of new houses, therefore the only possible way is for local authorities to purchase old houses and alter them—converting two cottages into one good one, or renovating old ones, than building houses which people are unable to go into.

This matter has never been considered seriously by the Housing Authorities (Central) at all.

Mr. E. WILLIS (Chiswick) said that he had already had some small experience in conversion of houses into flats, and agreed that in many cases this was both practical and beneficial, but there were some houses with basements which were most unsuited for such treatment, although even these were being altered in and near London, and adopted for tenement dwellings. The main point in rural districts was as to the structure. If that were good, then he agreed with the author of the paper, that alterations could be usefully carried out, but not otherwise.

It might be possible to acquire large houses in rural districts, which fail to let, and convert them into two or three smaller houses

Alderman JOSEPH HOWELLS, J.P. (Glamorgan C.C.). Architects do not like old houses patched up, they prefer to have new ones built, but I see no reason why old houses should not be made habitable in rural districts. Is there a more economical way of building houses than by bricks and mortar ?

*Re Local Authorities lending money to renovate houses.*—He had not heard of any local authorities doing so, but if after giving notice to the landlord to put a house in order, he failed to comply, the local authorities could step in, do the necessary work, and charge the landlord with the expense.

Mr. SMITH (Northumberland). The experience in Northumberland was that renovations could not be carried out to old houses until the present tenants had been removed. When tenants had moved into new houses the old ones could be repaired, but as the Ministry had cut down the number of houses to be erected in many districts, there were, in some instances, three applicants to every house erected, and, therefore, it did not appear that the renovation of old houses could be carried out.

A difficulty which would undoubtedly arise in the future would be the outcome of the Ministry's new policy of cutting down the previously agreed " housing needs " of the various districts.

It must not be forgotten that many local authorities have very unwillingly entered into their obligations in providing housing accommodation, and although the housing shortage in their respective districts had often been acute, they refused or neglected to use the enabling powers of the 1890 Act until they were compelled to do so by virtue of Section 1 of the 1919 Act.

Such authorities would receive the Ministry's "cutting down" programme with open arms and the position as regards the old houses would then be most deplorable.

Sanitary inspectors had been waiting for years for the acute housing shortage to be met by the provision of new houses so as to provide accommodation sufficient not only to relieve overcrowding, but to provide alternative accommodation for the thousands of families living in houses unfit for habitation, or which were so defective that the necessary ameliorative measures could not be carried out without the removal of the occupying tenants. The Ministry's previous efforts in "forcing up" the housing needs in the respective districts engendered a lively hope that these housing programmes would be shortly carried out and we should be able to get on with our part of the job, but the "cutting down" policy which was now officially adopted at headquarters, would mean that sanitary inspectors would have to wait several more years before they could begin their part of the national housing programme, that was (to quote Sec. 7 of the 1885 Housing Act), "to put into force the powers with which local authorities are invested so as to secure the proper sanitary conditions of all 'premises within the area under our control.'"

Miss COCHRANE (St. Neots). In reply to Mr. Alderman Joseph Howell's enquiry as to whether houses could be more economically built than by bricks and mortar, said in Cambridgeshire she was building a house with clay lump; in Norfolk many of that kind were built at from £95 to £100 cheaper than in brick. The rent question seemed to be an ever increasing problem, and had not been made easier by the Rent Restrictions Act.

## Cairo : A Brief Survey of its Drainage and Sanitary and Public Health Administration.

(Abstract.)

By Arthur H. Davis, F.S.I., F.I.San.E., F.A.I. (Member).

CAIRO is unique in many ways, not the least being the fact that it has no municipality of any kind, but all the services for the conduct of municipal life are entirely under the control of the Government, and I purpose dealing with the following Departments :—

*Main Drainage Department*, which is one of the services under the Ministry of Public Works, and that part of the *Public Health Department* which deals with :—

(*a*) Cairo Health Service.

(*b*) Cairo Scavenging Service.

(*c*) Water Service.

*Sanitary Conditions, 1882-1914.*—The drainage of Cairo at the time of the British occupation in 1882 can only be described as being most defective and unsatisfactory, on account of the generally primitive methods in vogue, and the large number of unpaved streets.

*Native Quarters.*—In the native quarters there were (and in many parts still are) only the most elementary sanitary arrangements, and sometimes none at all, but those provided by the mosques were rather better, but invariably filthy, the drains discharging into huge cesspools, which were emptied as required, and the common latrine frequently remains even to-day a hole at floor level situate in perhaps the entrance passage or just off the staircase, entirely unenclosed, or it may be partially partitioned off, and discharging directly into an unlined cesspool under house, or, it may be, the flat roof of the house, the street, or any available waste land.

It must be borne in mind that no water supply was or is laid on to the majority of the houses for domestic purposes, water required being purchased from water standards in the streets or the native water carrier, who carries his supply in a goatskin, and who usually announces his approach by ringing a small bell.

*European Quarter.*—In the European portion of Cairo, with its more up-to-date type of building, the sanitary arrangements were (and in many parts still are) on a par with those one might find in a Continental country town. All had water supply and trapped water closets with pans, but anti-syphonage was unknown.

*House Conveniences.*—All outlets from apparati led to a "French" soil pipe, and in a great many cases in houses 20 to 30 years old, lavatory, bath and

sink wastes were all connected into this frequently untrapped pipe, probably discharging direct into a cesspool under the house if no room available for it elsewhere, and examples of all these systems have been seen *and* smelt by the writer.

*Cesspools.*—The cesspool would be a cast iron septic tank in more modern cases, but is usually a brick or masonry pit, and badly made at that's a few run into a second chamber with " soak away " bottom, which in time gets choked. Now, when the River Nile rises, as it begins to in July (which is the effect primarily of the rains and then of the melted snows from Abyssinian mountains), the cesspools in low-lying districts are affected in consequence of the rise in the river causing a rise in level of sub-soil water, which in turn makes for an overflow of cesspools into cellars, gardens or streets adjoining.

*Emptying Cesspools.*—When necessary cesspools are pumped out by a local company known as the Cairo Sewage Transport Co. * The tank carts into which the cesspool drainage is emptied are fitted with necessary pumps.

It was not until 1916 that the designer and engineer of the sewerage scheme which is now practically complete was appointed by the Government. The scheme selected took, from first to last, in completing investigations, surveys, drawings and estimates, two and a half years, and the estimated cost, including macadamising the unpaved roads of native quarters, £E2,000,000.

The scheme is designed for a population of 1,000,000. The population in 1907 was 644,000, of whom 100,000 might be considered educated, and less than half of these only were Europeans.

The following paragraphs 19 and 20 of Report are quoted in full :—

19. It is proposed to abolish the existing " fosses etanches "** and " fosses à fond perdu,"† and I propose to divide the houses to be connected to the sewers into three classes, as follows :—

" Class A " : Houses, having an internal water distribution system, which is connected to the Cairo Water Co.'s mains.

" Class B " : Houses, of a good class, not connected to the Cairo Water Co.'s mains.

" Class C " : Sunburnt brick houses of inferior construction and " esheshes."‡

The " Class A " houses will be drained in the ordinary way, and, being mostly inhabited by the upper classes, the quantity of sewage from them will be estimated on a population basis.

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* This company has also branches all over Egypt in towns the size of which justify their establishing depôts. The contents of tank carts are taken to these depôts ; the solids are converted into fertilisers, the sale of which yield the company good profits.

** Cesspools. † Sump pits. ‡ Mud huts.

The " Class B " houses will be drained to a watertight collecting chamber, and the " Class C " houses to a form of gully, both connected to street sewers.

20. There are five sources, therefore, from which we may expect to derive sewage from the scheme, viz., the upper classes, the mosques, the public conveniences, flushing tanks, which must be placed under certain conditions at the heads of pipe sewers, and the drainage from " Class B " and " Class C " houses.

In addition of course to calculating the quantity of sewerage, there is the surface water, which is very limited and uncertain in quantity in Cairo, and averages about 1 in. annually. It was originally intended to use the separate system of sewerage wherever there was a suitable outfall for surface water. The Public Health Department was, however, opposed to the separate system being used at all, owing principally to the fact that the intake of the Cairo water supply is *below* the town. Therefore no surface water, largely on sanitary grounds, and partially on account of native sentiment, drains into the River Nile.

A portion of the city is drained by gravitation and the remainder by sectional system, each of which is provided with an arrangement for lifting the sewage (Shone Ejectors operated by compressed air), and discharging it into a sewer at a higher level, which in its turn usually discharges into the main collector.

Average depth of sewers in city and minor streets, 2 metres (6·56 ft.), in major streets 3 to $3\frac{1}{2}$ metres (9·84 ft. to 11·48 ft.).

One more extract from Report, and this as to gradient of sewers. The designer pointed out the fact that a greater minimum velocity for flow is required for an Oriental sewerage scheme than is usually the case, there being more extraneous matter in Oriental than in Occidental sewage, and he therefore has allowed for a minimum velocity for all sewers when flowing full or half full of 1·05 metres (3·12 ft.) per second.

*Native Population.*—To turn again to the native portion of the population, in view of the fact that there are frequently no sanitary arrangements, or only those of a most primitive and insanitary order in their houses, it has been necessary to provide accommodation for them by (*a*) public conveniences, (*b*) mosque latrines.

*Public Conveniences.*—As to (*a*) there are about 30 of these now* in existence in various parts of the native quarter, with an average latrine capacity of ten, thus providing accommodation for 300 persons at any one time. The number of latrines proposed at present is about 250. There is

* December, 1918.

always a native attendant on day duty, who at night sleeps on the ground inside the entrance !

*Mosque Latrines.*—With regard to (*b*) the Mosque Latrines, a Moslem going to pray in a mosque has to purify his body by washing before entering the place of prayer ; accordingly, in every mosque there is an ablution place in which there are w.c.'s and washing places. On entering an ablution place he generally proceeds to use the w.c., and after he washes his feet if they are bare, or else takes off his shoes or slippers, and steps into the ablution place, where he squats on a stone slab, and under water running from a tap washes his hands, mouth, nose, face, then the arms as far as the elbows, ears, hair, neck, three times, then his feet once ; then he proceeds to the praying place in the mosque, being theoretically bodily clean.

As there are extremely few mosques for women and no public conveniences, their habits are still very primitive.

A brief description of a mosque latrine may interest, since it is estimated that these are used by 150,000 persons per diem. These latrines are composed of porcelain fittings, each with a flushing rim and stone seat, and are connected by short lengths of pipe to 6 in. troughs ; there is also a small flush tank with chain.

For ablution purposes in the w.c. a small circular basin with tap and supply of water is placed at right-hand side of w.c.

The lengths of 6 in. troughs are flushed by water from the ablution places, which is collected in large flushing tanks, discharging automatically.

To wash and purify himself the man first goes to "standing" slabs, where he washes his feet, then to ablution places, and then he is cleansed as before described for mosque service, and enters the mosque by a gangway apart from the latrines.

Needless to say, the whole of the latrines are built of impervious materials, the doors alone being of wood, and where possible the designer harmonises the architecture with that of the main building.

*Functions of the Main Drainage Department.*—The Main Drainage Department of the Public Works Ministry deals primarily with the drains of Cairo, and advises on the schemes of any other towns in the country when called upon to do so. Application in Cairo to connect the drains to sewer must be in first instance made to the above named department, which causes an inspection of the premises to be made, reports on any alterations or additions required, approves plans, inspects works during construction, and finally passes work on completion ; and, further, no alterations or additions are permitted without the authorities' consent.

*Bye-laws, etc.*—There are no drainage bye-laws, regulations or decrees of any kind in existence at present time, although there is a draft scheme for

these already prepared. Only in 1914 was the first house drainage system connected to the new sewers, and at the end of December, 1918, 1,130 of the principal buildings in Cairo (and this includes hotels, blocks of flats, etc., but excludes Government buildings) had been connected thereto.

*Cairo Main Drainage Scheme.*—This consists of drainage by the Sectional and Gravitation systems.

The Sectional system is divided into sixty-three areas, each of which is provided with ejectors for forcing the sewage, by means of compressed air, through sealed sewage mains into the main collector at Port Ghamra. The compressed air required at each ejector is supplied through cast iron pipes laid in circuits to ensure continuous service throughout the city. Eighty kilometres (about 50 miles) of air and sealed sewage mains are needed for the Sectional system. Each ejector station consists of two spherical cast iron receivers of the necessary capacity to suit the requirements of each area and contained in a cast iron casing or tubing.

*Sewage Farm.*—This sewage farm is situate in the desert about 20 miles from Cairo, and is reached from the nearest railway station (nearly two miles away) by trolley.

At the farm the sewage is received in tanks, where it undergoes a process of sedimentation, and at the present time the effluent is passed direct on to the land, which is of such a nature that it is capable of absorbing it all.

The fertility of the farm is marvellous, and the green colour most refreshing to the eye, and in December, 1918, there were about 750 acres under cultivation.

*Department of Public Health.*—This Inspectorate is by no means the least important of those necessary to maintain and improve that "vast cosmopolitan Eastern city," Cairo.

*Inspection of Insanitary Houses, etc.*—There are no powers to close insanitary houses or buildings of any kind, nor any law to enforce owners to keep buildings sanitary.

*Cairo Scavenging Service.*—"There is an Arrêtè of the Ministry of the Interior, of June 7th, 1913, which forbids the deposit of any kind of rubbish or filth, house refuse, paper, straw, etc., on waste land or in any public street unless in a dustbin.

"House-to-house collection of rubbish, etc., is undertaken in certain streets, which may be indicated from time to time by Arrêtè.

"In such quarters or streets refuse must be deposited in public dustbins or in covered private bins easily handled. The latter bins are to be placed on the pavement outside houses, shops, etc., between dawn and 8 a.m. and 1 to 3 p.m. to allow of emptying, and must be withdrawn as soon as the agents of the scavenging service have removed contents."*

* Egyptian Government Almanac.

In the case of some large blocks of flats, the removal of the refuse is undertaken by a contractor, who pays for the privilege. Despite these regulations a large part of the native and poorer European quarters are frequently littered with garbage thrown from houses. This practice is dangerous, as it breeds flies.

As to street scavenging, there is an effective service of men and boys regularly employed, but it must be remembered that the cleansing of the streets does not present quite the same problem in Cairo as, say, in London, owing to the great difference in the rainfall. Against this, however, is the fact that the volume of animal traffic, horse, donkey, mule and camel, is vastly greater than that of motor-propelled vehicles, whilst in London motor-propelled vehicles largely preponderate.

*Water Service.*—This service is under the control of the Director of the Hygienic Institute of Cairo, who undertakes a regular inspection of all public water supplies, whether in the hands of the Government, of companies, or of private individuals.

The principal source of supply to Cairo is in the hands of a public company, established in 1865, and it should be mentioned that the intake of the water from the Nile is *below* Cairo—a somewhat unusual procedure.

Water, filtered (or unfiltered), is supplied to buildings by the cubic metre or at a fixed annual charge for gardens. There is usually a special tariff per metre for industrial establishments.

Time and space forbid further details, so now—" Khoulost."*

* Arabic—" I have finished."

## The Folkestone Waterworks Undertaking, 1848-1921.

By Henry T. Turner, Engineer to the Company.

THE Folkestone Waterworks owes its origin in 1848 to the late Mr. Richard Hart, a solicitor of this town, and started with a capital of £12,000. The reservoir in those comparatively distant days was an open pond with a capacity of about 1,000,000 gallons. Its situation was at the Cherry Gardens, well outside the town and at the base of the hills. This is the present site of the reservoirs that now supply the town. The original reservoir referred to (now known as the " Bateman " Reservoir) was fed by several springs running to it from the chalk at 220 ft. above O.D. To increase this supply it was found necessary to sink three wells (viz., Nos. 1, 2, and 3) to a depth of only 40 ft. through the clay into the Folkestone beds of the green sand. So far as I can gather from various sources a fair supply of water was obtained here. Geared pumps were fixed in Nos. 2 and 3 wells, and the pumping station was built over No. 1 well. A pair of engines in duplicate were fixed to drive the geared pumps, and the water was pumped into the No. 1 well. A pair of " A " frame engines were erected over the well, which pumped the water into the reservoir at the Cherry Gardens through a 12 in. rising main. The power of the pumps was 25,000 gallons per hour against a head of 85 ft. Folkestone at this time was but a small town which had gradually emerged from a village. Its population was chiefly composed of fishermen and a few smugglers or descendants of them. A 9 in. main was then laid into the town as far as the present Town Hall, and smaller pipes distributing the water over the different areas. In order to secure greater storage another reservoir, called the " Hart," was completed in 1851. The storage capacity of this was 7½ million gallons. These reservoirs were not concreted or bricked in any way, but I presume simply excavated and puddled with clay. Shortly after the completion of these works a supply of water was applied for by the military authorities at Shorncliffe Camp, which then comprised a collection of wooden huts. This involved further developments of the undertaking. The existing reservoirs were not high enough to afford this supply, and it was found necessary to build a high service tank. A site was picked out on the brow of the hill at 376 ft. above O.D. The tank at Shorncliffe is at 268 ft. The work of excavating was carried out, and a brick and covered tank built with a capacity of 80,000 gallons. An additional engine-house was built at about the level of the reservoirs, and an

intake to the well where engines and pumps were fixed of the same make and capacity of those at the Lower Works. These were constructed to pump against a head of 150 ft. A branch 6 in. main was taken from the 9 in. through Sandgate to Shorncliffe. This was also utilized for the supply of Sandgate. The date of this was 1857. At this time the supplies numbered only 245. As the population increased, however, it was found necessary to still further increase the storage capacity, and the "Bateman" reservoir was enlarged to a capacity of $2\frac{3}{4}$ million gallons. This supply was sufficient until 1891, when it was found necessary to create another works, which are situated about 500 yards to the west of the Lower Works. Three wells were sunk, viz., Nos. 4, 5 and 6. The two latter were sunk to a depth of 90 ft. into the Sandgate beds of the lower green sand, and an adit driven 500 ft. to connect them. A good supply of water was found, and an engine and boiler-house was erected over the No. 5 well, and quadruple engines and pumps were erected, each capable of raising a million gallons per day of 24 hours. Two Babcock boilers were put down, and these have been working in a satisfactory manner up to the present date. The water obtainable from this source at the present time is 600,000 gallons per day. The population had now increased to the following proportions, viz., Folkestone, 23,000 ; Cheriton, 4,000 ; and Sandgate, 2,000. In order to obtain a reserve supply, adits were driven into the chalk hills at the level of the reservoir, a distance of 2,000 ft. The supply obtained from this source ranges from 400,000 gallons in the winter to 60,000 gallons per day in a very dry summer. Another reservoir, the "Spurgen," named after the present Chairman of the Company, was now constructed, the capacity of which is 6,000,000 gallons. A high service brick covered reservoir was also constructed on the hillside, with a capacity of 650,000 gallons. This was for the upper part of Folkestone, where the supply from the reservoirs did not give a sufficient pressure. A main of 18 ins. diameter was at this time laid as far as the Town Hall. I may mention that previous to this a 12 in. main had been laid to the upper part of the town. On account, however, of the rapid increase in the population and two or three dry seasons, it was found necessary in 1897 to seek a further supply, and a well was sunk at Lower Standen. This well was in the chalk, and proved successful, a considerable quantity of water being found at a depth of 115 ft. Adits were also driven across the valley. An engine and boiler-house were erected, and engines and pumps fixed, each capable of pumping 1,000,000 gallons in 12 hours. The quantity of water obtained from this source ranges from 3,000,000 gallons in the winter to 1,000,000 gallons per day in very dry seasons. At the same period a well was sunk in the Lydden Valley, about three miles to the north-west of Standen. This well was carried to a depth of 160 ft. No great quantity of

water, however, was found. Subsequently, a 16 in. rising main was put down from these works to Standen, and a 21 in. main from Standen to the reservoirs at Cherry Gardens, a total distance of about six miles. The work of concreting the " Hart " and " Bateman " reservoirs was now carried out, and a wall 4 ft. 6 in. in height built round them in order to prevent any likelihood of contamination. These works have proved a great success, having been the means of assuring an ample supply up to the present. Owing, however, to the exceptionally dry season, and having in view the greatly increased and still increasing population in our districts of supply (viz., Folkestone, Folkestone-next-Sandgate, Shorncliffe Camp, Cheriton, Hawkinge, Alkham, Capel-le-Ferne, and Lydden), which we estimate to be from 60,000 to 70,000, we are now sinking another well in the chalk about 500 yards to the north-east end of our Standen works, and propose, at a depth of 118 ft., to drive an adit in the direction of a nailbourne known as Drellingore, which is situated about 400 yards to the north-east, and by still another adit connecting the pumping well at Standen, we hope to find a plentiful supply, as in some years this somewhat remarkable nailbourne yields anything up to 5,000,000 gallons daily. We have also just completed a new 12 in. main to the Folkestone Municipal Housing Scheme. Altogether the total length of mains laid down is 50 miles. The daily consumption of water is 1,700,000 gallons per day, which works out at about 25 gallons per head of the population. The capital expenditure of the company up to the present is in the neighbourhood of £270,000.

It will be seen from the foregoing that Folkestone possesses a magnificent supply of water, pure and in abundance. Its source is such that there can be no possible fear of contamination.

It may be of interest to relate that during the air raids a bomb was dropped into one of the reservoirs, but no harm accrued. On the hillside close at hand and on the east side of the lofty Cæsar's Camp, it will be noticed that the turf is scarred and the chalk underneath exposed. This was caused by a bomb that fell at the same time. During the war the works were guarded day and night by armed guards, whilst there was constant watchfulness on the hills above and around. In addition to the ordinary population many thousands of troops from all parts of the Empire, with the addition of a Chinese contingent, were stationed in our district. Mains had to be laid with all speed, but the works were able to meet all the demands made upon it. This was a strenuous time in the history of the company, and it is a proud record that it was able to serve our brave troops with all the water needed.

[Copy.]

South Eastern Analytical Laboratory,
Watling Chambers,
Canterbury.
*25th May, 1921.*

Water Analysis.—Folio 19210.
The Folkestone Waterworks Co.
Sample marked as below.
Received 24th May, 1921.

N.B.—All numerical results expressed in grains per gallon.

| | |
|---|---|
| Description or Number of Sample ... | "Tap off Supply Main." |
| Appearance ... ... ... ... ... | Clear. |
| Colour ... ... ... ... ... | Green-blue. |
| Smell ... ... ... ... ... | None. |
| Chlorine in Chlorides ... ... ... | 1·89. |
| Phosphoric Acid in Phosphates ... ... | None. |
| Nitrogen in Nitrates ... ... ... | 0·33. |
| Ammonia ... ... ... ... ... | None. |
| Albuminoid Ammonia ... ... ... | 0·0022. |
| Oxygen absorbed in 15 minutes ... ... | Trace only. |
| Oxygen absorbed in 4 hours ... ... | 0·016. |
| Hardness before boiling (total) ... ... | 17·1. |
| Hardness after boiling (permanent) ... | 2·8. |
| Total Solid Matter ... ... ... ... | 23·87. |
| Microscopical Examination of Deposit ... | Slight and unimportant. |

*Remarks.*—The above results are satisfactory throughout, and indicate water organically pure and free from sewage percolation. The microscopical examination is also satisfactory.

(Signed) Hawkins & Roberts.

## Some Lessons of the War.

By Col. C. H. Melville, C.M.G., M.B., late R.A.M.C. Being a Lecture to the Institute, delivered April 27th, 1921.

[After a few preliminary remarks of an introductory nature, the lecturer explained that the lessons on which he intended to touch were those only of which he had personal experience.]

The first in importance in point of time was the excellence of the British soldier. The men of the pre-war Army were not recruited from the best class, physically, of the nation. As in all voluntary armies with a limited period of engagement, our recruits came mostly from amongst the unemployed, temporarily unemployed as regards the majority. Their physique, on joining, was comparatively poor, and they were, as a rule, badly nourished. What the Army made of them it is not necessary for me to say. The men of Creccy, Fontenoy, Albuhera, or Inkerman, have no need to be ashamed of their successors, "the Old Contemptibles." The causes which produced this effect were good food and housing, a rational system of physical training, and life under discipline. The food and the housing they might have got in civil life ; there was nothing particularly luxurious about either, or out of the reach of a man in steady employment. The training and the discipline they could only have got, and even now can only get, in the Army, and I place the influence of these above that of the more material factors to which I have referred. The deduction is, I think, obvious : the lesson was there for anyone to learn before August, 1914, the proof of its truth was wanting, and the later months of that year furnished the proof. The next lesson I learnt was how infinitely better the physical material outside the Army was than that which we had got hold of in the ranks. This I learnt from inspecting the recruits of the New Army, especially the first three or four "hundred thousands." I have never, since I saw those men at Tidworth in 1914, been able to take very seriously the statements that were made later on about our being a C3 nation, and the rest of it. I don't say that there is not room for improvement, and that much more might not be done to improve the physical condition of the poorer classes, but I decline to take a pessimistic view of the future of the race. The stuff is there, and only needs a fair chance. But I most firmly believe that you will not get the best of it merely by improving material conditions. Training and discipline played as important a part as food and housing in making the pre-war recruit into the soldier of 1914. A man has higher needs, even from the physical point of view, than his belly and his back.

The next lesson I picked up was the terrible effect of an apparently trivial

disease when it attacks a non-immune population. The Highland Territorial Division, afterwards so well known to fame as the 51st, was stationed at Bedford in the first winter of the war. Out of its twelve infantry battalions three came from the Hebrides and the west coast of Scotland. Measles appeared in the division, and the other nine battalions suffered no more than one would have anticipated, but to the men of these Outer Islands measles was almost unknown, and, amongst the three battalions I have referred to, that usually trivial ailment showed itself as a malignant disease. The case mortality was 10 per cent., and the course of the illness reminded me of the worst days of enteric fever in India in the last century. In the event of another mobilisation, what should be done with troops from such localities as the Western Islands ? One cannot lock men up in a locality where measles are unknown ; sooner or later they must come into contact with the disease. Far better on all accounts that they should do so during the period of concentration than when they are actually in front of the enemy. We have no known method of prevention ; so trivial is the disease ordinarily considered that it has hardly seemed worth while to study the question. The only solution of the problem so long as we remain ignorant seems to be to accept the inevitability, and have everything ready for hospital treatment. The whole incident has always struck me as being of extraordinary interest ; it throws a strong, and not very pleasing light, on the limitations of our knowledge as regards even the most familiar of our diseases.

The next lesson I learnt was the important part played by vermin in spreading disease. It has always seemed to me, talking after the event, an extraordinary thing, and one not very creditable to the medical officers of the Army, that we had never in pre-war days studied the problem of disinfection of clothing in the field. It is not that we did not know that war and vermin are inseparable companions. Personal histories of previous campaigns abound in reference to the fact. It is not that we did not know, though it is true we knew it less certainly than we do now, that the body louse is a carrier from man to man of the virus of more than one contagious disease. It did not seem to have occurred to any one of us to put the two facts together, and point out the immense importance of having some organised method of ridding men's persons and their clothing and bedding of these parasites. In France the problem was fairly easily solved. In Egypt, where I came into contact with it, we did not possess the same facilities, and had to improvise methods suitable to our surroundings. (A description was given of some of these, especially the railway van system, devised by Col. Hunter, C.B., and Lt.-Col. Stammers, C.M.G., and the sack disinfector invented by Lt.-Col. Lelean, C.B.) Though designed for use in the field,

there are innumerable occasions in civil life where such a contrivance as Col. Lelean's would be invaluable. Being extremely portable, it can be taken to the place where it is needed, instead of the infected material being taken to the disinfector. I would not have referred even so shortly, or even at all, to this admirable contrivance except that it illustrates one point, and teaches us one lesson, which just at present, and in connection with Public Health, matters almost more than any other, is of the highest importance, namely, that efficiency can be attained without extravagance.

Lt.-Col. Lelean spent three years in apprenticeship to the indigenous industry of Egypt, the manufacture of bricks without straw. I know no better or more wholesome training or apprenticeship. In this country men have been accustomed to being provided with all the straw they have asked for ; they have insisted on having it, and usually asked for a good margin to ensure getting enough of it, and nothing but the best quality would do for them. Well, now they have got to learn the opposite habit. It isn't a pleasant lesson, but, after all, we have most of us been practising it in our own households for the last four years or more. And we must, I think, confess that it hasn't done any of us any particular harm. We must learn to carry out the same practice in Public Health matters, and I think we shall learn in a very short time how surprisingly well we can get along on these lines. And here I should like to refer to the immense benefit that would accrue not only to the individual men themselves, but also to the State, if all medical practitioners in rural districts went through a course of instruction in Field Sanitation. Such men cannot afford the time or money to go through the regular D.P.H. course, but a fortnight spent at a good demonstration centre, such as the London Sanitary Companies established in Egypt, would teach them a great deal that would be invaluable to them in practising rural sanitation.

My next lesson is rather a declension from the high moral level to a low material one. I refer to the lesson of cleanliness. I imagine that the general opinion on the subject of cleanliness is that it is a habit which conduces to one's personal respect, and one's individual comfort.

One of the lessons of the war is that dirt is a direct cause of disease, first, because it implies the presence of vermin, and, secondly, because it conduces to septic poisoning, affecting the numerous slight cuts and scratches inevitable in campaign life. This is so much the case that the formation of special units is, I believe, in contemplation, whose function will be to provide facilities for periodical and systematic bathing and laundry for even advanced formations. The lesson has been learnt and remembered by most of the men who served in the ranks in the war. It is one of my duties to examine recruits, and I have been struck by the comparative rarity nowadays of a

dirty man. The men I see, or rather lads, are too young to have been in the war themselves, so that they must have learnt the practice from their fathers. It may be objected that perhaps they learnt it at school. If so, it is about all they did learn, for beyond their alphabet their ignorance in other directions is extreme. I have been specially struck by the excellent condition of their teeth. Before the war a recruit with well-cleaned teeth was the exception, now one with dirty teeth is quite as rare. I have noticed, too, that the men called up in the Reserve a fortnight ago were beyond comparison cleaner than the men who came up in 1914 in the New Armies, and this applies to the single men as well as the married. In fact, of upwards of a couple of hundred whom I examined, not one looked as if he had not had a bath at least the day before.

The last lesson to which I shall refer, perhaps the most important of all, is that of the importance of science in the national life. In the past the British nation has neglected science in the most extraordinary manner. Our individual scientists need not fear comparison with those of any other country. Most of the epoch-making discoveries have been made in Great Britain. I need only refer to the names of Darwin in biology, Lyell in Geology, Simpson and Lister in medicine. But whilst the discovery has been made by us, the practical application has too often been allowed to fall into the hands of foreigners. Think only of the monumental discovery of aniline dyes, made by an Englishman, whilst the profits have been reaped by the Germans. And not only the pecuniary profits. The great dye factories of Germany were one of their most important military assets.

Education is necessary. The problem is not, however, I confess, a simple one. Are we to teach science to lads of 15 or 16 ? If so, how ? We can teach them dogmatically, of course, and that means that the boy learns something as an absolute fact in 1921 which he finds to be not quite so absolute in '23, and perhaps entirely untrue in '25. You may dogmatise about Homer and Virgil, but not about electricity or chemistry. Or you can go to the other extreme, and teach them only the scientific spirit by making them question everything, and judge only for themselves. Are their minds fit for such a load at or shortly after puberty ? We know that the minds of many men are not fit for it even in adult life, as witness the amount of plausible quackery that is accepted for science by even educated men.

But you can teach boys to be interested in science, and to recognise its importance in daily life. That is possible, and it does not demand any great outlay in laboratory equipment such as the teaching of research demands. True research men are very rare, and bad researchers are the most dangerous members of the community, especially if they have the " gift of the gab " and can persuade the great British public that their half-baked results are real scientific discoveries.

# THE ROYAL SANITARY INSTITUTE.

FOUNDED 1876.

## REVIEWS OF BOOKS.

### DOMESTIC SANITARY ENGINEERING AND PLUMBING.*

This is a valuable and comprehensive treatise on the subject, and will be found of great value to students of Domestic Sanitary Engineering and Plumbing. The illustrations are well selected and clearly drawn, and the worked-out examples of the various formulas are in simple form, and should be clear to any student who earnestly wishes to fully qualify himself in this subject. H.D.S.

### MANUAL FOR HEALTH VISITORS AND INFANT WELFARE WORKERS.†

Mrs. Eve, who edited this volume, chose her contributors carefully and judiciously, for included amongst them are such well-known authorities on Infant Welfare work and the duties of health visitors as Professor Bostock Hill, Dr. Sidney Davies, Miss Halford of the Association of Infant Welfare and Maternity Centres, and several prominent health visitors. Each writer, being an authority on the subject entrusted to him or her, has been very concise, and as a result the volume is quite a small one. Within a small compass, however, there has been compressed an extraordinary amount of most useful information. Dr. Bostock-Hill's preface is full of advice and encouragement, and Dr. Davis, in his articles on the relation of the health visitor to the medical officer of health, and on maternity and infant welfare centres offers hints that are likely to prove of great value. Mrs. Eve herself writes interestingly and with knowledge on the duties of health visitors at the centres; and on visiting, office and committee work, &c. The section on tuberculosis is from the pen of Miss Amy Sayle, of the Ministry of Health. In preparing it she had the advantage of the assistance of Dr. Shinnie, Tuberculosis Officer, Westminster, and the article is very practical. The whole book, indeed, is practical, and for this reason may be recommended. C.P.

### POVERTY AND ITS VICIOUS CIRCLES.‡

In few branches of work are there so many " vicious circles " as in public health, and the herculean task given to the medical officer of health and those with him is the breaking of these circles. Inasmuch as by reason of the advances in connection with maternity and child welfare work and the introduction of the Milk (Mothers and Children) Order these officers have been made more or less distributors of relief, they have had added to the number of circles they must help to break that with which this volume deals. As a guide to the nature of the circle and the methods that may be adopted in connection with its breaking nothing better probably could be found than

* DOMESTIC SANITARY ENGINEERING AND PLUMBING, by F. W. Raynes. 4to., 474pp., illustrated. London, 1920. Longman's, Green & Co. Price 21s.

† MANUAL FOR HEALTH VISITORS AND INFANT WELFARE WORKERS, edited by Mrs. Enid Eve. 4to, 194pp. London, 1921. John Bale, Sons & Danielsson, Ltd. Price 10s. 6d.

‡ POVERTY AND ITS VICIOUS CIRCLES, by Jamieson B. Hurry, M.A., M.D. 4to, 411pp. London, 1921. J. & A. Churchill. Price, 15/-.

this book of Dr. Hurry's. It is written interestingly, and with knowledge and sympathy, and though specially recommended to members of religious and philanthropic institutions, to charity organization societies and councils of social welfare, it is well worthy of study by medical officers of health and health workers generally. C.P.

SANITATION IN COUNTRY PLACES, INCLUDING THE BACTERIOLYTIC TANK.*

The author, who is permanent head of the South Australian Public Health Department, and a keen disciple of the late Dr. Vivian Poore, begins by describing Nature's way of destroying organic wastes and utilising the resulting products. He describes the dry earth closet system and means for dealing with urine and slop water in the absence of drains, as well as methods of garbage disposal.

The second half of the book is devoted to a description of the " Bacteriolytic Tank System." No novelty is claimed for the system itself, but the name " bacteriolytic " is proposed in substitution for " septic," which is objected to as inapplicable and misleading. The author does not profess to deal with the treatment of sewage on a large scale, and his book is primarily written for the guidance of those who have small quantities of sewage to dispose of.

The method recommended is to pass the sewage through two tanks arranged in series, and generally about equal in size. It is important not to disturb the scum which forms in the first tank. The sewage accordingly enters it through a submerged inlet, passes on into the second tank through a submerged connecting pipe (in the form of a siphon), and is drawn off from the latter by a submerged outlet. Both tanks are covered, but the upper parts (above the scum level) may be in communication. The second chamber should have an air inlet and a raised outlet, both fitted with gauzes to exclude mosquitoes.

In the first compartment the sewage solids are disintegrated and dissolved, and in the second " further decomposition, involving oxidation and nitrification, occurs." " The final product is a liquid that is inoffensive to smell and even harmless to drink." This is a surprising claim, and it is not supported by any analyses. We have no experience in this country which would justify us in expecting any appreciable amount of oxidation or nitrification to take place under the conditions described. In view of the statements which are freely made here to the effect that a septic tank cannot deal with its sludge, it is interesting to note that rarely has a bacteriolytic tank required to be cleaned out, and then only on account of some defect of structure or management. Some tanks have been in use for 18 years without costing a single penny. Since 1908, 2,059 tanks, of capacities up to 2,000 gallons, and serving from 4 to 600 people, have been laid down.

The effluent is disposed of by sub-surface irrigation through open-jointed pipes, or by means of a " soakage well." The latter method would rarely be considered safe in this country in connection with an unfiltered effluent.

The book is well written and very readable, and contains a score of excellent illustrations. A. J. M.

* THE THEORY AND PRACTICE OF SANITATION IN COUNTRY PLACES, INCLUDING THE BACTERIOLYTIC TANK SYSTEM, by W. Ramsay Smith, M.D., D.Sc., F.R.S. Edin. 8vo, 64 pp. Adelaide, 1921. R. E. E. Rogers.

## MEETINGS HELD.

### Examinations.

Since the last issue the following examinations have been reported :—

Birmingham, July 8th and 9th.

Aberdeen, July 15th and 16th.

London, July 29th and 30th.

*For Inspectors of Meat and other Foods.*

Birmingham, July 22nd and 23rd.

At these examinations 217 candidates presented themselves, and the following were awarded certificates :—

*Sanitary Science as applied to Buildings and Public Works.*

Coe, Victor Rembrant, *London.*
Reeve, Harry Austin, *Norwich.*

*Maternity and Child Welfare Workers.*

Carmichael, Emily, *Birmingham.*
Cross, Wilhelmine, *Croydon.*
Skene, Lily, *London.*
Tamplin, Ellen Mary, *Bedfont.*

*Women Health Visitors and School Nurses.*

Back, Frances Rebecca, *Ringwood.*
Bain, Violet Helen, *Aberdeen.*
Beardson, Bertha Serina, *Marylebone.*
Bremner, Doris Marion, *Lewes.*
Brothers, Theresa, *Blackburn.*
Collins, Nora J., *Bow.*
Cooper, Minnie, *Romsey.*
Cordon, Jane, *Shelfield.*
Creswell, Mary Isabel, *Hounslow.*
Forbes, Margaret, *Aberdeen.*
Freeman, Alice Mary, *Forfar.*
Green, Margaret Edith, *London.*
James, Constance A. G., *Lewes.*
Hamilton, Edith Eliza, *Wednesfield.*
King, Elsie Southam, *London.*
Law, Isabella Catherine, *Glasgow.*
Lowndes, Margaret, *Desborough.*
MacKilligan, Alice, *Aberdeen.*
Marshall, Grizel, *Ladybank.*
Martin, Beatrice Sarah, *Walsall.*
Martin, Lilian, *Harborne.*
McCambridge, Kathleen, *Regent's Park.*
Monk, Winifred May, *Colchester.*
Montague, Louisa Gwendoline, *Stourbridge.*
Morris, Helen Louise, *Ely.*
O'Connell, Alice Kathleen, *Halesowen.*
Roche, Annie Kate, *Edmonton.*
Salway, Linda Gladys, *Newbury.*
Saunders, Annie, *Walsall.*
Slack, Margaret E., *Burnley.*
Southall, Bessie Irene, *Saffron Walden.*
Stebbings, Helen Mary, *Blackheath.*
Stevenson, Jane Cecily, *Willesden Green.*
Thompson, Rosina Penney, *Creaton.*
Tyrrell, Amy Edith, *Isleworth.*
Vieler, Alberta Victoria, *London.*
Williams, Florence Helen, *Gomersal.*
Woolrich, Ada, *Wolstanton.*

*School Hygiene, including Elementary Physiology.*

Beck, Margaret Alice, *Bedford.*
Blackwell, Hettie, *Erdington.*
Gannaway, Helen Maud, *Birmingham.*

GITTINGS, FLORENCE LYDIA, *Erdington.*
GROVES, SHEILA CAMERON, *Bedford.*
HITCHENS, IRENE LILLIAS, *Erdington.*
HUGGARD, BERYL MARY, *Bedford.*
HUGHES, MARY CERIDWEN, *Erdington.*
LAST, GERTRUDE ELAINE, *Bedford.*
NEWTON, MARGARET, *Erdington.*
PARSON, WINNIFRED, *Birmingham.*
PRESTON, ETHEL MARGARET, *Bedford.*
STRUDWICK, MARY PHYLLIS, *Bedford.*
TENCH, HELEN MARY, *Bedford.*
WEBSTER, MARY KATHERINE BARBARA, *Erdington.*
WILLSON, JOAN SYLVIA DRAKE, *Sydenham.*
WILSON, FRANCES EMBBYN, *Bedford.*

*Inspectors of Nuisances.*

BENNETT, ALEXANDER, *Buckie.*
BELL, FREDERICK REGINALD, *Southsea.*
BLACKIE, GEORGE THOMAS HERBERT, *Stourbridge.*
BOOTH, ARTHUR, *Stafford.*
BRANT, HERBERT, *Grimsby.*
CARRAGHER, JOSEPH PHILIP, *Leeds.*
CHELL, EDWIN, *Thetford.*
CURETON, LOUISA, *Coventry.*
DONELLY, ERNEST, *Wigton.*
EVATT, GORDON LAURENCE, *Leicester.*
GIBBON, HERBERT, *Ripon.*
GRIEVE, DEBORAH, *Doncaster.*
GROOM, ALBERT CHARLES, *W. Ealing.*
HARROLD, EDGAR, *Langley.*
HIGLEY, FLORENCE SARAH, *Birmingham.*
LUNN, GEORGE HENRY VICTOR, *Walthamstow.*
MATTHEWS, FREDERICK ROBERT, *Exeter.*
MCLYNCHY, ROYAL, *Exmouth.*
MORRISON, HELEN MURRAY, *Enfield.*
NASH, DAVID PERCY, *Cannock.*
NAUGHTIN, THOMAS HUGH, *New Southgate.*
NEWBURY, GEORGE FENNELL, *Bristol.*
NIXON, ELLEN, *Doncaster.*
PENN, GEORGE HENRY, *Sawbridgeworth.*
RILETT, JOHN. *Evesham.*
SEARLE, FLORENCE ELIZABETH, *Doncaster.*
SHERRATT, EDGAR GARNET, *Stoke-on-Trent.*
SIMPSON, CHARLES FREDERICK, *Leeds.*
SMART, CECIL BERESFORD, *Southsea.*
SMITH, ELSIE NORA, *Norwich.*
SMITH, HAROLD, *Bournville.*
SWAIN, FREDERICK WILLIAM, *Banbury.*
TYLER, ALBERT, *Bristol.*
TYLER, RICHARD JOSEPH, *Sidcup.*
UPCOTT, JANET MARY, *Dudley.*
WARNER, PERCY ALBERT, *Godalming.*
WATERS, BLANCHE, *London.*
WATSON, JAMES, *Aberdeen.*
WILSON, GEORGE, *Aberdeen.*

*Inspectors of Meat and other Foods.*

CATTLIFF, JOHN WILLIAM, *Sheffield.*
CHANCE, JOHN DAVIS, *W. Bromwich.*
DAVIES, JOHN HENRY, *Wolverhampton.*
EVANS, OSBORNE, J., *New Tredegar.*
HALE, CHARLES KENNETH TEAGUE, *Chesterfield.*
HURST, DOUGLAS, *Stoke-on-Trent.*
MUSGROVE, ALICE M. HUGH, *Dowlais.*
OWENS, BRINLEY DAVID, *Swansea.*
SHAW, GEORGE HERBERT, *West Bromwich.*
THURMAN, JOHN WILLIE, *Wolverhampton.*

*Smoke Inspectors.*

LONGFELLOW, ALEC., *Birmingham.*

# FORTHCOMING MEETINGS.

## Lectures.

The Introductory Lecture to the Autumn Courses of Lectures will be delivered by Prof. H. R. Kenwood, C.M.G., M.B., D.P.H., F.R.S.E., on September 19th, at 5.30 p.m.

The Course for Sanitary Officers will commence on September 21st; for Health Visitors and Child Welfare Workers on September 23rd; for Meat and Food Inspectors on September 30th; and for Army Officers and Professional Men on November 11th.

## Sessional Meeting.

**Stoke-on-Trent.**—Friday, October 7th. The Members will be received in the Town Hall at 4.30 p.m., and entertained at Tea at 5 p.m. by the Right Worshipful the Mayor. At 7.30 p.m. discussions will take place on "Activated Sludge," to be opened by W. H. Makepeace, Sewage Works Engineer and Manager, and on "Smoke Pollution of the Atmosphere," by G. Petgrave Johnson, M.D., D.P.H., Medical Officer of Health, Stoke-on-Trent.

On Saturday, October 8th, visits will be made to Activated Sludge Plant, Pottery Works, Housing Scheme sites, Model Iwel Meat and Fish Salvage Plant, and to Infectious Diseases Hospital at Bucknall, where the members will be entertained at Tea by the Joint Hospital Board.

London, Wednesday, October 12th, at 4 p.m., discussion on "Ship Sanitation."

## Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, Maternity and Child Welfare Workers, Women Health Visitors and School Nurses, and School Hygiene, including Elementary Physiology, will be held at :—

York, October 7th and 8th.
Leicester, October 14th and 15th.
Liverpool, October 21st and 22nd,
Newcastle, October 28th and 29th.
Manchester, November 18th and 19th.
London, December 9th and 10th.
Auckland and Christchurch, December

For Inspectors of Meat and other Foods :—

Newcastle, November 11th and 12th.
Liverpool, November 25th and 26th.
London, December 16th and 17th.

## Examination in Tropical Hygiene for Inspectors of Nuisances.

The organisation of the Public Health Service throughout the Empire is modelled on very similar lines and the standard examination for Sanitary

Inspectors held on an uniform syllabus in nearly all the Overseas Dominions has been generally adopted.

The principles that guide Public Health administration are the same in all places, but variations in practice have to be adopted, especially in the tropics, to make the work apply effectively to local conditions, and many newly appointed officers have to learn these conditions after they are in office.

The Council have decided to establish, in sequence with the present standard examination for Inspectors of Nuisances, a supplementary examination on a syllabus covering the general application of this work to tropical conditions.

The syllabus of subjects and regulations for the Examination will be issued in November and arrangements are being made for the first Examination to be held in London on April 21st and 22nd, 1922.

### Health Week, October 9th-15th.

Several County and Local Authorities, including some in the Overseas Dominions, have sent communications with regard to the arrangements they propose for Health Week, and in London the Education Committee of the County Council have approved of a scheme for offering prizes for essays written by the children in the London Schools, the title for the essays being Habits and Health. The teachers will be asked to arrange for lessons during the term to bear upon the subject.

The scheme arranged by the Central Committee applies only to London, but it is hoped that other centres will adopt some measures for including the influence of the schools in furthering the practice of Health, Happiness and Efficiency.

Donations towards the expenses of the Central Committee have been received from the British Commercial Gas Association £100. The Prudential Assurance Company £52 10s., Refuge Assurance Company £21, London and Manchester Assurance Company £10 10s.

The method of procedure and suggestions as to the general arrangements that may be made to celebrate Health Week were set out in the Supplement to the July Journal, p. 12, and all the members and associates of the Institute are asked to keep the proposal before the Local Authority and their Officers with a view to some steps being taken to emphasise, during the week, the personal care of Health.

## DOMINION AND FOREIGN NOTES.

In July, M. Edouard Montpetit, Secretary General of the Comité France-Amérique (Section Canadienne), visited the Institute and Museum for the purpose of gaining information regarding the reduction of Infant Mortality.

## Calendar for September, 1921.

### SEPTEMBER.

19 M. Introductory Lecture to Students attending the Autumn Courses, at 5.30 p.m., by Prof. H. R. Kenwood, C.M.G., M.B., D.P.H., F.R.S.E.

21 W. Lecture to Sanitary Officers, at 6 p.m. Public Health Acts—English, Scotch, Irish ; other Statutes relating to Public Health, by Wellesley Harris, M.R.C.S., L.S.A., D.P.H., M.O.D., Lewisham.

23 F. Lecture to Sanitary Officers, at 6 p.m. Public Health (London) Acts, etc., by A. Wellesey Harris, M.R.C.S., D.P.H.

23 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Personal Hygiene, Importance of Cleanliness, by J. A. H. Brincker, B.A., M.D., D.P.H.

26 M. Lecture to Sanitary Officers, at 6 p.m. Factory and Workshop Acts, Smoke Legislation, Food and Drugs Acts, 1899, by A. Wellesley Harris, M.R.C.S., D.P.H.

26 M. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. The Growth and Development of the Child, by J. A. H. Brinckner, B.A., M.D., D.P.H.

27 Tu. Lecture to Sanitary Officers, at 6 p.m. Duties of a Sanitary Inspector. General, A, Outdoors, by A. Wellesley Harris, M.R.C.S., D.P.H.

28 W. Demonstration to Sanitary Officers, at the Public Health Offices, 10, Compton Terrace, Upper Street, Islington, N., at 6 p.m. Book-keeping as carried out in a Sanitary Inspector's Office, by James R. Leggatt, Superintendent, Public Health Department.

28 W. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Hygiene of the Special Senses, by Margaret C. M. Hogarth, M.B., CH.B.

29 Th. Lecture to Sanitary Officers, at 6 p.m. Duties of a Sanitary Inspector. General, B, Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

30 F. Lecture to Sanitary Officers, at 6 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

30 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Physical Development, by Margaret C. M. Hogarth, M.B., CH.B.

30 F. Lecture to Meat Inspectors at the Institute, at 6 p.m., by J. R. Hayhurst, M.R.C.S., D.V.S.M. (Vict.), Superintendent, Metropolitan Cattle Market.

### OCTOBER.

1 S. Inspection and Demonstration in the District of Chiswick, at 2.30 p.m. Conducted by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

3 M. Lecture to Sanitary Officers, at 6 p.m. Elementary Science : Physics, Chemistry, by Alan E. Munby, M.A., F.R.I.B.A.

3 M. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Physical Conditions affecting Health in Schools, by Margaret C. M. Hogarth, M.B., CH.B.

4 Tu. Lecture to Sanitary Officers, at 6 p.m. Elementary Science : Physics, Chemistry, by Alan E. Munby, M.A., F.R.I.B.A.

5 W. Lecture to Sanitary Officers, at 6 p.m. Elementary Science : Physics, Chemistry, by Alan E. Munby, M.A., F.R.I.B.A.

5 W. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Home Economics and Cookery, by Mrs. K. Lomax-Earp.

5 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Kemble Street, Drury Lane, W.C., at 2.30 p.m.

7 F. Lecture to Sanitary Officers, at 6 p.m. Elementary Science : Physics, Chemistry, by Alan E. Munby, M.A., F.R.I.B.A.

7 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Duties and Powers of Health Visitors, by G. F. Buchan, M.D., D.P.H., M.O.H., Willesden.

7 F. Lecture to Meat Inspectors at Institute, at 6 p.m., by J. R. Hayhurst, M.R.C.V.S.

7 F. } Examinations—York.
8 S. }

7 F. } **Sessional Meeting—Stoke-on-Trent.** Discussions on "Activated Sludge,"
8 S. } opened by W. H. Makepeace, Sewage Works Engineer and Manager; and "Smoke Pollution of the Atmosphere in the Potteries," by G. Petgrave Johnson, M.D., D.P.H., Medical Officer of Health.

8 S. Inspection and Demonstration at Fox Farm, Sanderstead, near Croydon, at 2.30 p.m. Conducted by P. B. Tustin.

8 S. Demonstration—Meat Inspectors, at Metropolitan Cattle Market, at 12.30 p.m. Conducted by J. R. Hayhurst, M.R.C.V.S.

**9-15.—HEALTH WEEK.**

10 M. Demonstration to Sanitary Officers in the Parkes Museum, at 5.30 p.m., by the Director, E. White Wallis, F.S.S.

10 M. Lecture to Sanitary Officers, at 6 p.m. Elementary Statistics, by Joseph Priestley, M.D., D.P.H., M.O.H., Lambeth.

11 Tu. Lecture to Sanitary Officers, at 6 p.m. Infectious Diseases, by Joseph Priestley, M.D., D.P.H.

12 W. **Sessional Meeting, London.** 4 p.m. Discussion on "Ship Sanitation."

12 W. Lecture to Sanitary Officers, at 6 p.m. Methods of Disinfection, by Joseph Priestley, M.D., D.P.H.

12 W. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Hygiene of the Home, by Mrs. S. Seekings Friel, M.D., D.P.H.

12 W. Inspection and Demonstration in the District of Islington, at 2.30. Conducted by James R. Leggatt, Superintendent, Public Health Department, Islington.

14 F. Lecture to Sanitary Officers, at 6 p.m. Water: Composition, Pollution and Purification, by Joseph Priestley, M.D., D.P.H.

14 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Sociological Conditions, by Mrs. S. Seekings Friel, M.D., D.P.H.

14 F. } Examinations, Leicester.
15 S. }

15 S. Demonstration—Meat Inspectors, Metropolitan Cattle Market, at 12.30 p.m. Conducted by J. R. Hayhurst, M.R.C.V.S.

15 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by Joseph Priestley, M.D., D.P.H.

17 M. Demonstration to Sanitary Officers in the Parkes Museum, at 5.30 p.m., by the Director, E. White Wallis, F.S.S.

17 M. Lecture to Sanitary Officers and Health Visitors and Child Welfare Workers, at 6 p.m. Sanitary Appliances, by W. C. Tyndale, O.B.E., M.INST.C.E.

19 W. Lecture to Sanitary Officers and Health Visitors and Child Welfare Workers, at 6 p.m. House Drainage, by W. C. Tyndale, O.B.E., M.INST.C.E.

19 W. Inspection and Demonstration at Cook's Soap Works, Bow, at 2.30 p.m.

21 F. Lecture to Sanitary Officers, at 6 p.m. Details of Plumbers' Work, by Walter Scott.

21 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Water Supply: Fittings and Ventilation in the Home, by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

21 F. Lecture to Meat Inspectors at Institute, at 6 p.m., by J. R. Hayhurst, M.R.C.V.S.

21 F. } Examinations—Liverpool.
22 S. }

22 S. Inspection and Demonstration at South West Suburban Water Works, Staines, at 2.30 p.m. Conducted by Henry Adams, M.INST.C.E.

24 M. Lecture to Sanitary Officers, at 6 p.m. Calculations, Measurements and Plans and Sections, by W. C. Tyndale, O.B.E., M.INST.C.E.

24 M. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Home Visiting and Advice, by Miss Alice Moss, Sanitary Inspector and Health Visitor, Battersea.

25 Tu. Lecture to Sanitary Officers and to Health Visitors and Child Welfare Workers, at 6 p.m. Ventilation and Warming, by Edward Willis, Esq., A.M.INST.C.E., F.S.I., Engineer and Surveyor, Chiswick.

26 W. Inspection and Demonstration in the District of Islington, at 2.30 p.m. Conducted by James R. Leggatt, Superintendent, Public Health Department, Borough of Islington.

28 F. Lecture to Sanitary Officers, at 6 p.m. Building Materials, by Edward Willis, A.M.INST.C.E., F.S.I.

28 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Health Talks and Home Nursing, by Mrs. Lomas-Earp, Matron, Health Institute, Kilburn.

28 F.
29 S. } Examinations—Newcastle.

29 S. Demonstration—Meat Inspectors, Metropolitan Cattle Market, Islington, N., at 12.30 p.m. Conducted by J. R. Hayhurst, M.R.C.V.S.

29 S. Inspection and Demonstration at Schools and Public Buildings, Chiswick, at 2.30 p.m. Conducted by Edward Willis, A.M.INST.C.E., Engineer and Surveyor, Chiswick.

31 M. Lecture to Sanitary Officers, at 6 p.m. Building Sites, by Edward Willis, A.M.INST.C.E., F.S.I.

31 M. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Organisation and Management of Infant Welfare Centre and Clinics, by Charles Porter, M.D., B.SC., M.O.H., St. Marylebone.

## NOVEMBER.

1 Tu. Lecture to Sanitary Officers at 6 p.m. Sewerage, by H. C. Adams, M.INST.C.E.

2 W. Inspection and Demonstration in the District of Chiswick, at 2.30 p.m. Conducted by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

2 W. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Official and Voluntary Agencies Administering to Child Welfare: the Children Act, by Charles Porter, M.D., B.SC.

4 F. Lecture to Sanitary Officers, at 6 p.m. Sewage Disposal, by H. C. Adams, M.INST.C.E.

4 F. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Prevention of Communicable Disease, by R. Veitch Clark, M.A., M.D., B.SC., D.P.H.

4 F. Lecture to Meat Inspectors, at 6 p.m., by J. R. Hayhurst, M.R.C.V.S., D.V.S.M.

5 S. Inspection and Demonstration at East Ham Sewage Disposal and Refuse Destructor Works, at 2.30 p.m. Conducted by H. C. Adams, M.INST.C.E.

5 S. Demonstration to Health Visitors and Child Welfare Workers, in the Parkes Museum at 3 p.m. Conducted by J. H. Clarke.

7 M. Lecture to Sanitary Officers, at 6 p.m. Water Supply, Sources of Supply and Distribution, by H. C. Adams, M.INST.C.E.

7 M. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Prevention of Communicable Disease, by R. Veitch Clark, M.A., M.D., B.SC., D.P.H., M.O.H., Croydon.

9 W. Lecture to Sanitary Officers at 6 p.m. Scavenging, Disposal of House Refuse, by W. R. Hicks, A.M.INST.C.E., Borough Engineer and Surveyor, Ealing.

9 W. Lecture to Health Visitors and Child Welfare Workers, at 6 p.m. Tuberculosis, by R. Veitch Clark, M.A., M.D., B.SC., D.P.H.

# LIST OF HONORARY FELLOWS, MEMBERS AND ASSOCIATES.

ELECTED JULY, 1921.

* Sanitary Science Certificate.
*w* Maternity and Child Welfare Workers Certificate.
§ Sanitary Surveyors' (India) Certificate.
‡ Inspectors of Nuisances Certificate.
*m* Inspectors of Meat and other Foods Certificate.
*v* Women Health Visitors' and School Nurses' Certificate.
*s* School Hygiene Certificate.

## FELLOWS.

1909.
2709 *F 1921. July* AYLING, Robert Stephen, F.R.I.B.A., *Bedford House, 108, Baker Street, W.1.*

1919.
4334 *F 1921. July* BROADBENT, Benjamin, C.B.E., J.P., M.A., *Gatesgarth, Lindley, Huddersfield.*

1916.
3971 *F 1921. July* FINCH, Ernest Edward, M.INST.C.E., *Guildhall, E.C. 2.*

1908.
2513 *F 1921. July* FRENGLEY, Joseph Patrick, M.D., B.CH., F.R.C.S.I., D.P.H., *Dept. of Public Health, Hospitals and Charitable Aid, Wellington, New Zealand.*

1909.
2729 *F 1921. July* HOWARD-JONES, John, M.D., D.SC., C.M., *Health Department, Town Hall, Newport, Mon.*

1908.
2471 *F 1921. July* JACK, Gavin Heynes, M.INST.C.E., F.G.S., *County Surveyor, Shirehall, Hereford.*

1918.
4431 *F 1921. July* JOHNSON, Edward Angas, M.D., CH.D. (GOTT.), M.R.C.S., L.R.C.P. (LOND.), *295, Pirie Street, Adelaide, South Australia.*

1908.
2563 *F 1921. July* MINETT, Edward Piggott, M.D. (BRUX.), D.P.H. (CANTAB.), D.T.M. & H., M.R.C.S., L.R.C.P., *Government Public Health Dept., Georgetown, Demerara.*

1921.
4760 *F 1921. July* NEWSHOLME, Sir Arthur, K.C.B., M.D., F.R.C.P., *Ashley House, Shalford, Surrey.*

1910.
2825 *F 1921. July* WILKINSON, Frank, M.INST.C.E., *Council Offices, Dyne Road, Kilburn, N.W. 6.*

## MEMBERS.

4737 1921. July ATLAS, Henry, F.C.S., *Analytical Chemist, "Barbrook," 10, Ailsa Road, Westcliff-on-Sea.*

4738 1921. July BATES, Henry Baker, C.B.E., J.P., L.S.A., *Parkside, Taylor Park, St. Helens, Lancs.*

4739 1921. July BREBNER, Charles Stuart, D.S.O., M.D., CH.B., D.P.H., (*M.O.H. & S.M.O.*), *Public Health Dept., 38, Sheen Road, Richmond.*

4740 1921. July BURNHAM, The Rt. Hon. Viscount, C.H., LL.D. (CAMB.), LL.D. (MCGILL), *13, Bryanston Square, W.* (*Hall Barn, Burnham, Beaconsfield, Bucks.*).

4741 1921. July CLEMENTS, Archibald Arthur, B.SC. (LOND.), *5, Elderton Road, Westcliff-on-Sea.*

4742 1921. July COLES, Donald Alexander, M.R.C.S., L.R.C.P., *31, Winsor Terrace, Beckton, North Woolwich.*

4754 1921. July *vw*CRAGG, Miss Lily, *Health Dept., Council Offices, Ashton-in-Makerfield.*

4743 1921. July DAY, James John, O.B.E., M.R.C.S., L.R.C.P., D.P.H., (*M.O.H.*), *E. Kent No. 2 United District, 52, Whitstable Road, Canterbury.*

4744 1921. July. ‡DEELEY, George Plant, *Moushall Farm, Amblecote, Brierley Hill, Staffs.*

4745 1921. July GARROW, Robert Philip, M.D., D.P.H., (*M.O.H. & S.M.O.*), *The Health Office, Chesterfield.*

4755 1921. July *HINDLE, John Leslie, *38, Mexborough Road, Bolton Woods, Bradford.*

4746 1921. July IQBAL, Mir Ali Khan, B.SC. (TECH.), *College of Technology, Whitworth Street, Manchester.*

4747 1921. July JITTA, N. M. Josephus, M.D. (AMSTERDAM), *Chairman of the Sanitary Council of Holland, Frankenslag 137, The Hague, Holland.*

4756 1921. July §KALE, Keshava Rama Chandra, *Sanitary Inspector in charge Tawahi and Steampoint Division, Aden.*

4748 1921. July KIRKHOPE, David Connor, M.D., CH.M., D.P.H., (*M.O.H.*), *Town Hall, Tottenham, N. 15.*

4749 1921. July MACKENZIE, Melville Douglas, M.D., D.T.M. & H., D.P.H., *City Hospital, Walker Gate, Newcastle-upon-Tyne.*

4757 1921. July *m*MILNER-JONES, Major Francis Edward, R.A.S.C., *Royal Barracks, Dublin.*

4760 1921. July NEWSHOLME, Sir Arthur, K.C.B., M.D., F.R.C.P., *Ashley House, Shalford, Surrey.*

4750 1921. July PORTER, William Ernest, M.D., M.R.C.S., D.P.H., J.P., (*M.O.H. & S.M.O.*), *The Larches, Trinity Road, Wood Green, N. 22.*

4758 1921. July *PRICE, Richard Edward, *Surveyor's Office, Town Hall, Holyhead, Anglesey.*

4751 1921. July RADNOR, The Rt. Hon. The Earl of, *Longford Castle, Salisbury.* (LIFE MEMBER.)

4752 1921. July VILLAR, Sidney, F.R.C.V.S., *Veterinary Inspector for County of Middlesex, Amersham Common, Bucks.*

4753 1921. July WILLIS, Edmund John, A.M.INST.C.E., *Engineer's Dept., Town Hall, Edmonton, N. 9.*

4759 1921. July *WILSON, Harry, *36, North Side, Clapham Common, S.W. 4.*

## ASSOCIATES.

8603 1921. July *v*BALL, Miss Phœbe, *10, Crossway, Shotton, Chester.*

8604 1921. July ‡BEBBINGTON, Percy, *28, Millstone Lane, Nantwich, Cheshire.*

8605 1921. July ‡BETTRIDGE, Jeffery Leonard, *1, Alexandra Avenue, Southall.*

8619 1921. July ‡BOX, Allan Cyril, *District Engineer, P.W.D., Galle, Ceylon.*

8606 1921. July *v*BRADLEY, Miss Isabella, *" The District Nurses Home," St. Helens, Lancs.*

8607 1921. July ‡BRIDGES, Miss Mary Agnes Maude, *5, Burlington Gardens, W. 1.*

8608 1921. July ‡BRIGGS, James Troke, *13, Grosvenor Street, Agbrigg Road, Wakefield.*

8609 1921. July ‡COX, John William, *Ropergate, Pontefract, Yorks.*

8610 1921. July ‡EVANS, Thomas J., *Tymaen, Porthcawl, Glam.*

8611 1921. July ‡HERBERT, David Charles, *Brynsiencyn, Llanfair, P.G., Anglesey.*

8620 1921. July ‡HOC, Miss Mary Françoise, *75, Hereford Road, W. 2.*

8621 1921. July ‡JARVIS, Miss Mary Sprott, *17, Faraday Road, Acton, W. 3.*

8612 1921. July ‡OCCLESHAW, James, *22, Bryn Street, Ashton-in-Makerfield.*

8613 1921. July ‡PLEWES, Lawrence, *2, Clifton Gardens, Goole, Yorks.*

8614 1921. July ‡SWIFT, Sydney, *16, Princess Street, Castleford, Yorks.*

8615 1921. July *v*TAYLOR, Miss Bessie Maud, *8, Cavendish Road, Leeds.*

8616 1921. July ‡THOMAS, Frederick Charles, *37, Junction Lane, St. Helens, Lancs.*

8617 1921. July ‡TREW, Basil Molineux, *136, Garden Lane, Chester.*

8618 1921. July ‡WILLIAMS, Miss Alice Eliza, *King Edward VII. Hospital, Cardiff.*

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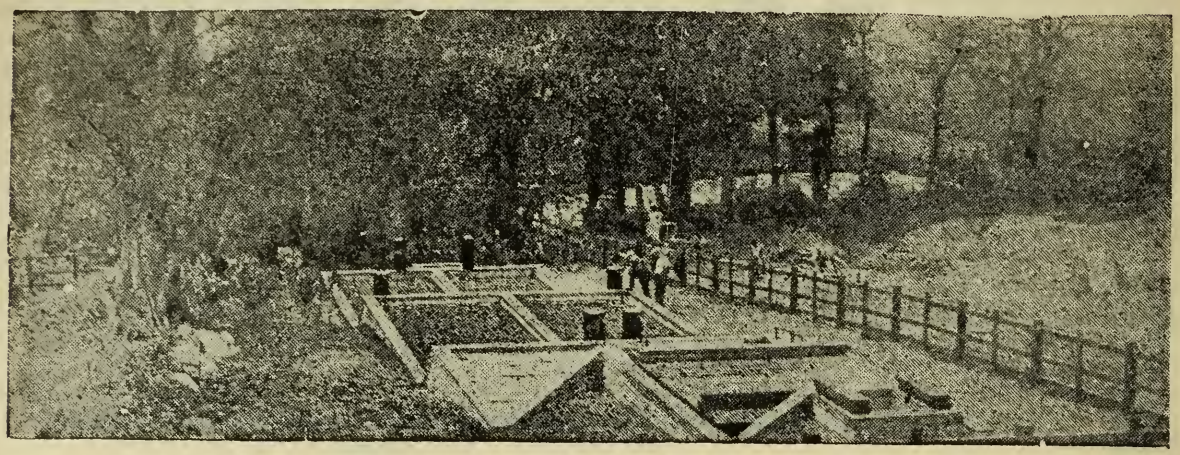

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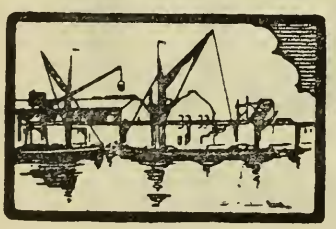

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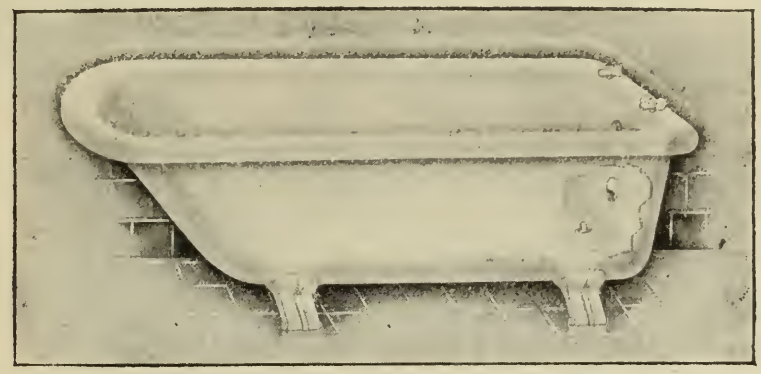

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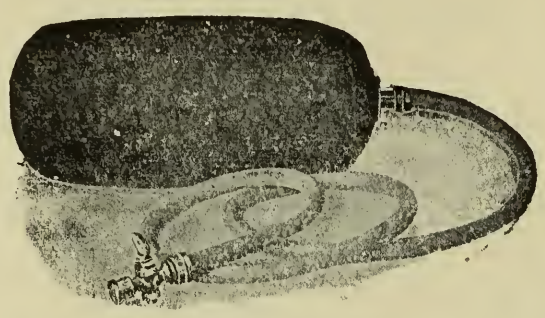

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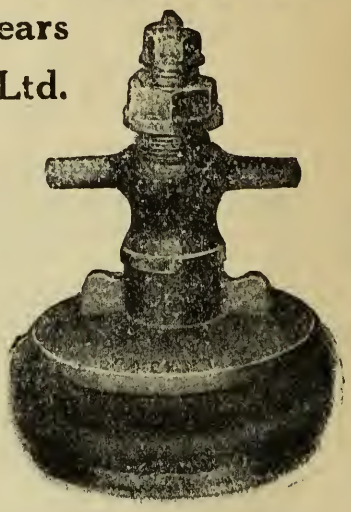

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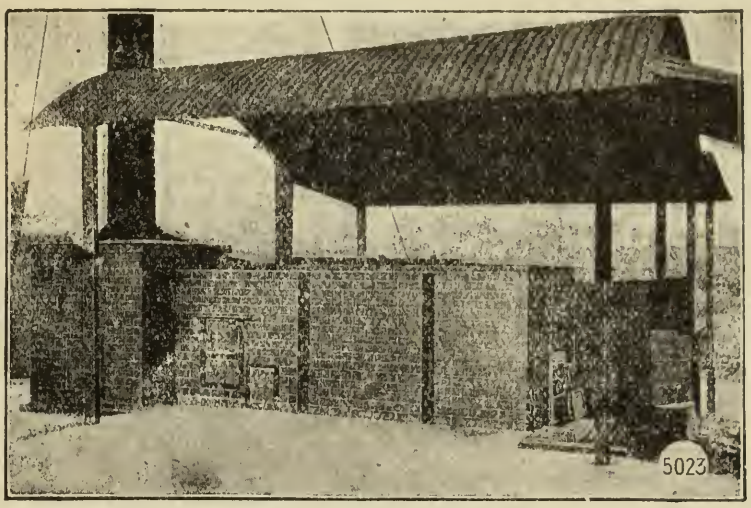


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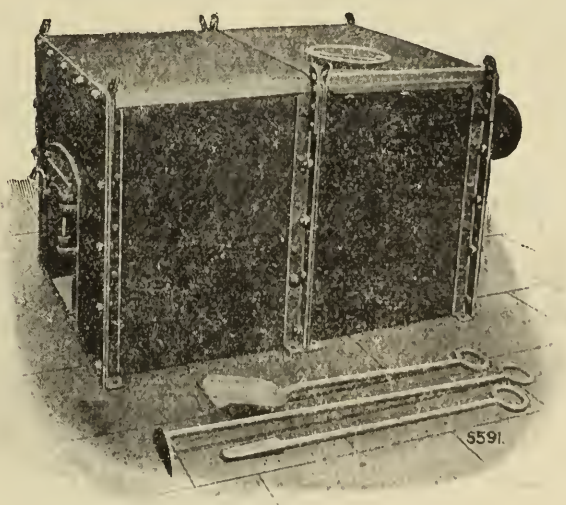


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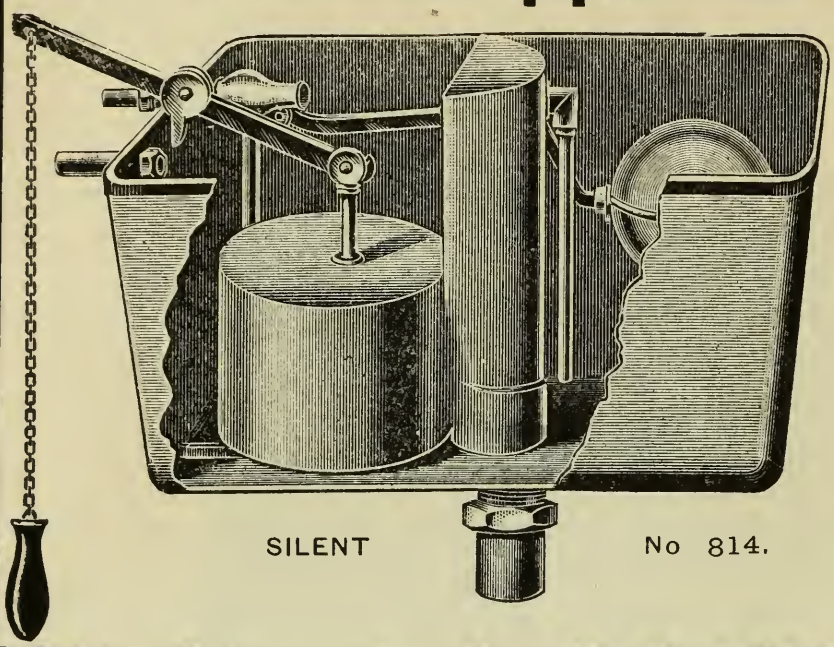

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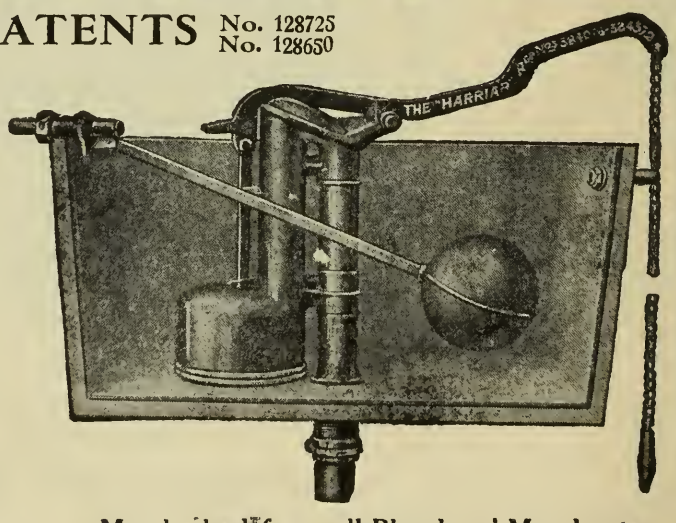


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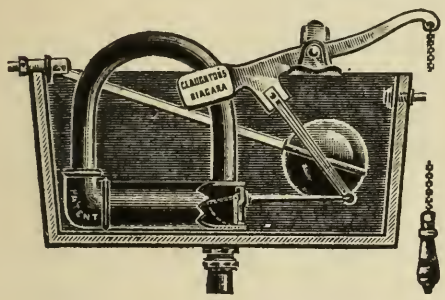

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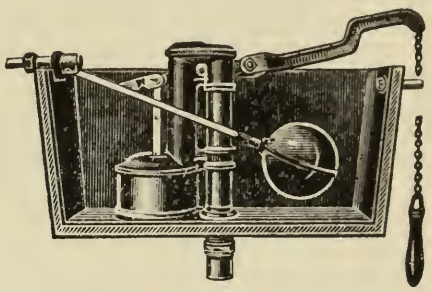

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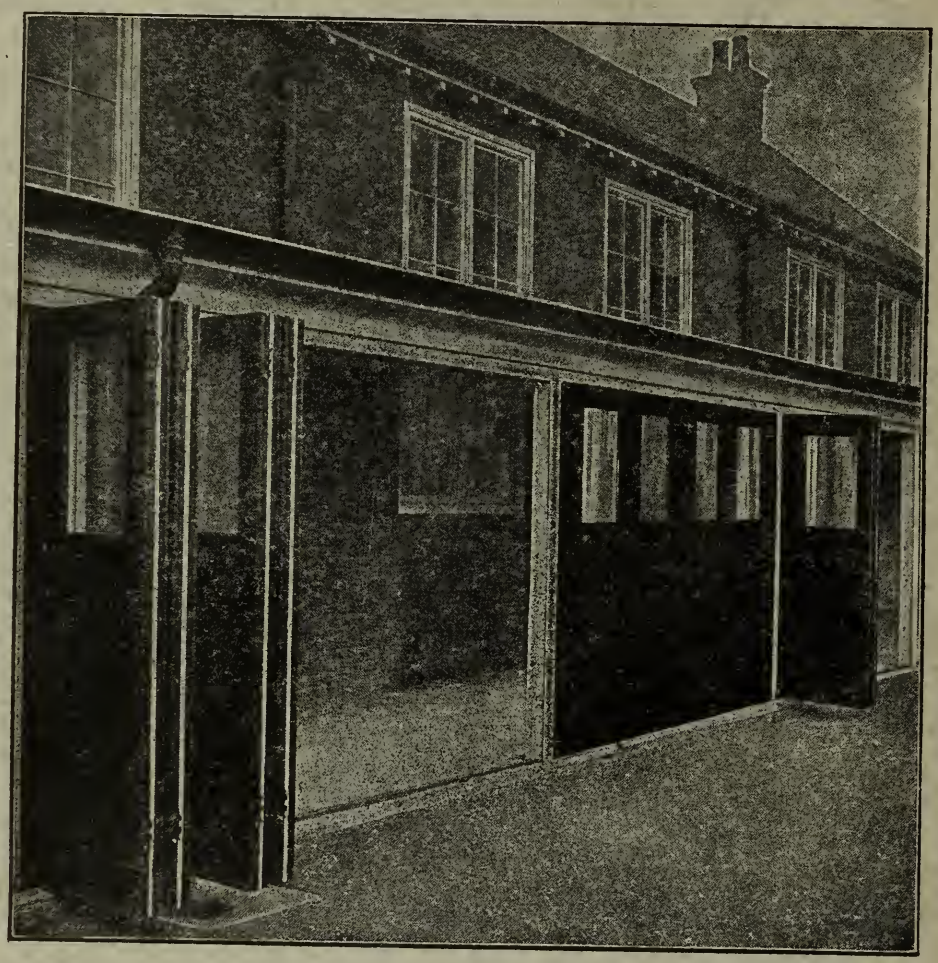

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